FOURTEENTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

STATE BOARD OF HEALTH

OF THE

STATE OF MICHIGAN,

FOR THE

FISCAL YEAR ENDING SEPTEMBER 30, 1886.

MICHIGAN STATE BOARD OF HEALTH SEAL.

BY AUTHORITY.

LANSING, MICH.:
THORP AND GODFREY, STATE PRINTERS AND BINDERS.
1888.

Office of the Secretary of the State Board of Health,
LANSING, MICHIGAN, *December, 1886.*

TO HON. RUSSELL A. ALGER, *Governor of Michigan:*

SIR:—In compliance with the laws of this State, I present to you the accompanying Report for the fiscal year ending September 30, 1886.

Very Respectfully,

HENRY B. BAKER,

Secretary of the State Board of Health.

RESOLUTION OF THE BOARD RELATIVE TO PAPERS PUBLISHED IN ITS ANNUAL REPORT.

Resolved, That no papers shall be published in the Annual Report of this Board except such as are ordered or approved for purposes of such publication by a majority of the members of the Board; and that any such paper shall be published over the signature of the writer, who shall be entitled to the credit of its production, as well as responsible for the statements of facts and opinions expressed therein.

RESOLUTION OF THE BOARD RELATIVE TO PAPERS PUBLISHED IN ITS ANNUAL REPORT.

Resolved, That no papers shall be published in the Annual Report of this Board except such as are ordered or approved for purposes of such publication by a majority of the members of the Board; and that any such paper shall be published over the signature of the writer, who shall be entitled to the credit of its production, as well as responsible for the statements of facts and opinions expressed therein.

CONTENTS.

ILLUSTRATIONS.

REPORT.

This is the fourteenth Annual Report of the Secretary of the State Board of Health, and is for the fiscal year ending September 30, 1886. It is arranged and paged in two parts. The first contains the Secretary's report of work of the Board, the annual report of property, including accessions to the library with names of donors. The second part contains fourteen papers, abstracts, and reports.

To this report there are supplements containing proceedings and addresses at the sanitary conventions held at Howell, March 3 and 4, 1886; at Kalamazoo, June 1 and 2, 1886; and at Coldwater, Sept. 9 and 10, 1886.

The papers are printed subject to a resolution of the Board, on page iv.

The names and postoffice addresses of the members of the Board, and the date of the expiration of their terms of office, are as follows:

ARTHUR HAZLEWOOD, M. D., Grand Rapids, Jan. 31, 1887.

JOHN AVERY, M. D., *President of the Board,* Greenville, Jan. 31, 1887.

VICTOR C. VAUGHAN, M. D., Ph. D., Ann Arbor, Jan. 31, 1889.

C. V. TYLER, M. D., Bay City, Jan. 31, 1889.

HENRY F. LYSTER, A. M., M. D., Detroit, Jan. 31, 1891.

JOHN H. KELLOGG, M. D., Battle Creek, Jan. 31, 1891.

HENRY B. BAKER, M. D., *Secretary of the Board,* Lansing.

The members of the State Board of Health, with the exception of the secretary, are appointed for the term of six years, and receive no salary for their services.

STANDING COMMITTEES.

1. Epidemic, Endemic and Contagious Diseases.—H. F. Lyster, M. D.
2. Sewerage and Drainage.—H. F. Lyster, M. D.
3. Foods, Drinks, and Water-Supply.—V. C. Vaughan, M. D.
4. Buildings, including Ventilation, Heating, etc.—John Avery, M. D.
5. Climate, Geology, Topography, etc.—Henry B. Baker, M. D.

6. Disposal of Excreta.—John H. Kellogg, M. D.
7. Poisons, Explosives, etc.—V. C. Vaughan, M. D.
8. Occupations, Recreations and Habits.—J. H. Kellogg, M. D.
9. Relations of Schools to Health.—John Avery, M. D.
10. Sanitary Survey.—C. V. Tyler, M. D.
11. The Death-Rate, as Influenced by Age.—Henry B. Baker, M. D.
12. Legislation.—C. V. Tyler, M. D.
13. Finances of the Board.—Arthur Hazlewood, M. D.
14. Mental Hygiene.—Arthur Hazlewood, M. D.
15. Diseases of Animals Dangerous to Man.—Henry B. Baker, M. D.
16. Relations of Preventable Sickness to Taxation.—J. H. Kellogg, M. D.

WORK OF THE OFFICE OF THE BOARD, FISCAL YEAR 1885.

The work of the office naturally groups itself under three closely related heads,—the collection of information, the compilation and elaboration of information, and the dissemination of information. In the following outline that grouping has been made in part only in order to avoid repetition.

COLLECTION AND COMPILATION OF INFORMATION.

ANNUAL REPORTS BY HEALTH OFFICERS FOR THE YEAR ENDING DEC. 31, 1885.

In January, 1886, a circular (97) which had been approved by the Board, was sent to the health officer of each township, city, and village in the State, about 1,422 in all, transmitting a blank form [I] for use in making his annual report to this office. This circular was subsequently the same as circular 65 which is printed on pages viii—ix of the report for 1884. Blank form I. for report of health officers is printed in former Reports. The circular (97) also transmitted a blank for a copy of the record of diseases dangerous to the public health, similar to the blank which is printed, reduced in size, on page 271 of the Report for 1882.

ANNUAL REPORTS BY CLERKS OF LOCAL BOARDS OF HEALTH, FOR THE YEAR ENDING DEC. 31, 1885.

At the same time (January, 1886) that the circulars and blank forms were sent to the health officers, a circular (96) asking for a report, and a blank form [J] on which to make a report, were sent to the clerk of the local board of health of each township, city, and village in the State, about 1,422 in all. A blank form for a copy of his record of cases of diseases dangerous to public health was also sent, the circular and blank form sent to the clerk were similar to those sent to the health officer, except that they were not so explicit in questions relating to sickness and deaths.

Replies by 26 correspondents to circular 98, relative to diseases in Michigan in 1885, have been received and are on file for any use for which they may be needed.

WEEKLY REPORTS OF DISEASES IN 1885.

A list of observers for the calendar year 1885 is printed on pages 97-99. A compilation of reports, with a study of relations of sickness to climatic conditions, is printed on page 81-147. A copy of the circular (61) used in asking for reports by health officers of villages is printed on page xii. of the Report for 1883.

HEALTH BULLETINS.

The weekly reports of diseases received up to Wednesday of the week following the week for which they are made, are compiled on that day, week by week, and a bulletin, based on the compilation, is sent for publication to a large number of newspapers, and to sanitary and medical journals. A telegraphic abstract from the compilation is also sent weekly to a Michigan Press Association. A specimen of this weekly health bulletin can be found on page xii. of the Report for 1884. Beginning with the month of August, 1884, a monthly health bulletin has been issued immediately after the close of each month, for the use of monthly sanitary and medical journals. A specimen of the monthly bulletin can be found on page ix. of the Report for 1885.

NAMES AND ADDRESSES OF HEALTH OFFICERS OF TOWNSHIPS, CITIES AND VILLAGES.

In April, 1886, the usual demand was made upon supervisors of townships, presidents and clerks of villages, and mayors and clerks of cities, for return of the names and postoffice addresses of health officers. The circular and blank forms used are similar to those printed on pages xiii.-xiv. of the Report for 1884. In June, 1886, a second demand was sent to 490 localities from which no return had been made in response to the demand in April. In July, 1886, a list of the health officers and of their postoffice addresses was printed, when, of the 1,438 townships, villages, and cities in the State, it was found that all but 238 localities were provided with health officers as the law requires. This number, during the following months of August and September, was reduced to about 218. The number of townships, villages, and cities that fail or refuse to comply with the law relative to the appointment of health officers, has on the whole diminished greatly since the organization of the Board, which denotes increasing vigilance in regard to public health. There is reason to believe that, in a few years, every locality in Michigan will constantly keep a health officer.

As fast as addresses of health officers for 1886 were received, a document detailing the duties of health officers was sent to each, together with blanks and copies of the documents on prevention and restriction of diphtheria, scarlet fever, typhoid fever, and small-pox.

METEOROLOGICAL REPORTS.

A list of meteorological observers for the calendar year 1885, with a statement of what registers were received from each, is printed on page 9. The reports are summarized in an article on the Principal Meteorological Conditions in Michigan in the Year 1885, on pages 1–81. The data are of great value for purposes of studying the causes of diseases. The observations made at the office of the Board, at Lansing, have been summarized weekly, and a copy kept on file in the office.

THE PREVENTION OF TYPHOID FEVER.

The document of this Board [99] on "The Prevention of Typhoid Fever," is printed on pages 148–153.

TYROTOXICON.

Two papers by Dr. V. C. Vaughan on this subject,—one read July 13, and the other Oct. 1, before the Board, are printed on pages 154–164 of this Report.

REPORT OF COMMITTEE TO VISIT NEGAUNEE.

On the urgent invitation of the health officer of Negaunee, Mich., to visit that city, the Board sent a committee, and the report of the committee is printed on pages 167–168 of this Report.

REPORT ON SANITARY CONDITION OF NORTHERN ASYLUM FOR INSANE.

It is printed on pages 169–170.

ANALYSIS OF 500 DEATHS,—MICHIGAN MUTUAL LIFE INSURANCE CO.

An article by Dr. Henry F. Lyster, analyzing 500 deaths which occurred among the members of the Michigan Mutual Life Insurance Company during the 18 years of its organization, is printed on pages 189–195 of this Report.

CAUSATION OF PNEUMONIA.

An article on this subject by Dr. Henry B. Baker, is printed at the close of this report.

AMERICAN MEDICAL ASSOCIATION.

The report of attendance on this association, by Dr. Arthur Hazlewood, is printed on pages 165–166.

EXAMINATION OF MONTCALM COUNTY JAIL.

The report of the examination of the sanitary condition of the Montcalm county jail, by J. H. Kellogg, M. D., is printed on pages 171–175.

NATIONAL CONFERENCE OF STATE BOARDS OF HEALTH.

The report of attendance on the National Conference of State Boards of Health at Toronto, October, 1886, by Dr. Henry B. Baker, is printed on pages 176–188.

INJURIES FROM ILLUMINATING OILS IN MICHIGAN IN 1885.

The report on this subject is printed on pages 196–198.

OTHER DISSEMINATION OF INFORMATION.

Increased effort has been made to disseminate a knowledge of the nature of contagious diseases and the danger therefrom, by sending documents on the restriction and prevention of such diseases where they are likely to be read. Neighbors of families in which such diseases occur are most likely to read the documents and conform to the suggestions they contain. In order to gain a more general compliance with the law requiring physicians to report cases of contagious diseases, a copy of the following was sent to the physicians in Michigan:—

CIRCULAR TO PHYSICIANS RELATIVE TO REPORTING CASES OF COMMUNICABLE DISEASES.

OFFICE OF THE SECRETARY OF THE STATE BOARD OF HEALTH,
[105.] *Lansing, Michigan, April, 1886.*

DOCTOR:—Because of additions to the ranks of physicians, and for other reasons, this Board deems it advisable to ask the attention of physicians to the law requiring them to report cases of diseases dangerous to the public health to the local health officer or to the president or clerk of the local board of health.*

While this law is now obeyed by many physicians, much remains to be desired. Some physicians stop in their compliance with the law after reporting the first case of a number they treat about the same time, and that seem to have a common origin. The law clearly intends that every case of a

* Section 1735 of Compiled Laws of 1871, being Section 1676 of Howell's Annotated Statutes as amended by act No. 11, Laws of 1883, reads as follows:—"Whenever any **Physician** shall know that any person whom he is called to visit, or who is brought to him for examination, is infected with small-pox, cholera, diphtheria, scarlet fever, or any other disease dangerous to the public health, he shall immediately give notice thereof to the health officer, the president, or the clerk of the board of health of the township, city, or village in which the sick person may be; and to the householder, hotel keeper, keeper of a boarding house, or tenant within whose house or rooms the sick person may be. The notice to the officer of the board of health shall state the name of the disease, the name, age, and sex of the person sick, also the name of the physician giving the notice; and shall, by street and number, or otherwise sufficiently designate the house or room in which said sick person may be. And every physician and person acting as a physician, who shall refuse or neglect immediately to give such notice shall forfeit for each such offense a sum not less than fifty nor more than one hundred dollars: *Provided*, That this penalty shall not be enforced against a physician if another physician in attendance has given to the health officer, or other officer hereinbefore mentioned, an immediate notice of said sick person, and the true name of the disease, in accordance with the requirements of this section."

A new section (50) added by Act No. 11, Laws of 1883, allows a physician ten cents, to be paid by the local board of health, for each complete notice made in accordance with this section.

dangerous communicable disease shall be reported, together with the name, age, and sex of the person sick.

In all cases where practicable, the notice should be given to the health officer, rather than to the president or clerk, because he has important duties to perform under the law.

It will add greatly to our knowledge of these dangerous diseases if physicians will also inform local health officers of the time of death or recovery of each case.

Physicians in attendance upon cases of communicable diseases should not advise the removal of placards from the premises until the health officer is satisfied that the disease is no longer present on the premises, and that disinfection has been thoroughly performed.

This Board regards *Typhoid Fever* as a communicable disease, and one coming under the section quoted below. Cases of this disease should be reported to the health officer, the same as cases of small-pox, scarlet fever, or diphtheria.

This State Board is now prepared to assist local health officers in preventing and restricting typhoid fever.

By direction of the State Board of Health,
HENRY B. BAKER, *Secretary*.

Whenever information is received of the occurrence of diphtheria, scarlet fever, small-pox, or typhoid fever, copies of a document on the restriction and prevention of the disease reported are immediately sent to the health officer, with a request that he distribute them where they will be likely to be read. Copies of the documents on diphtheria, scarlet fever, and small-pox, in German or in Dutch, are also sent when it is thought they can be used to advantage. Owing to frequent request for documents in French, Polish, Swedish, and Danish-Norwegian, translations of a leaflet on contagious diseases (47) have been made into each of these languages; and copies are sent to local boards when so requested.

A record is kept of reports received and of correspondence relative to each outbreak of a dangerous communicable disease of which the office receives information.

On receipt of the names and addresses of health officers, documents on restriction and prevention of diphtheria, of scarlet fever, of small-pox, and of typhoid fever, and on the work of health officers and local boards of health, are sent to each; and if each health officer would study these documents carefully, he could thereby acquire necessary information for the right performance of his duties.

The Annual Report of this Board for the year 1885 has been distributed to all health officers whose names have been reported to this office, to presidents and clerks of city and village boards of health, and to many other officers and citizens interested in public health work. The proceedings of the meetings of the Board have been printed in pamphlet form and given to the press.

REPORT OF THE SECRETARY RELATIVE TO PROPERTY, ETC., FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1886.

To the President and Members of the Michigan State Board of Health:

GENTLEMEN:—In compliance with Section 5 of Article II. of the by-laws of this Board, the following report of the "Nature and amount of property belonging to the Board, which has been received,

issued, expended and destroyed since the last report, and of the property remaining on hand, and also in whose care each item of property is intrusted," is respectfully submitted:

My last report is printed on pages xiii.-xxvii. of the Annual Report for the year 1885. Since last report, instruments and articles of a similar nature have been purchased as follows:

Four photo-engraved plates, to illustrate paper on "Relations of Sewerage and Water-supply to Death-rate in Cities."
Nine photo-engraved plates—Meteorological conditions in Michigan in 1884.
One basin for rain gauge.
One wood-cut illustrating plan of ventilation.
Two photo-engraved plates to illustrate paper on "The water-supply of Howell."
Photo-engraved plate showing distribution of diphtheria in Michigan in 1885.
Photo-engraved plate showing distribution of scarlet fever in Michigan in 1885.
Fifteen photo-engraved plates, meteorological conditions in Michigan in 1885.
Two photo-engraved plates to illustrate paper on "History of investigations concerning micro-organisms."

Meteorological instruments have been entrusted to observers as follows:
One wet-bulb thermometer to J. H. Kellogg, M. D., Battle Creek.
One barometer, one set of registering thermometers, one rain gauge with measuring stick, one cup for psychrometer, transferred by A. W. Nicholson, M. D., to A. E. Martin, Boyne City.
One measuring stick for rain gauge, one cup for psychrometer, one maximum registering thermometer to S. Alexander, Birmingham.
One basin for rain guage, 30 feet of cotton rope (for use in well-water measurement), one minimum registering thermometer (to replace one accidently broken), to office of Secretary of the State Board of Health.
One standard thermometer to Milton Chase, M. D., Otsego.
One psychrometer, one set of registering thermometers, one rain gauge, one board, two clips, one cup and wick for psychrometer, one board for registering thermometers, to W. B. Rosevear, Bay Port, Huron county.
Instruments, etc., remaining in the office of the Board, September 30, 1886:
Six dry-bulb thermometers.
Five wet-bulb thermometers.
One standard thermometer.
Two maximum thermometers.
Two minimum thermometers.
Eleven clips for hanging thermometers.
Two caps for additional tubes for rain gauges, to catch overflow.
Four scales for thermometers, tubes broken.
One standard barometer.
Three barometer boxes.
Two psychrometers, complete.
Two psychrometer boards with cups and clips.
One psychrometer board with clips.
One set of registering thermometers, complete.
One board with clips for registering thermometers.
One rain gauge and one measuring stick.
One stem-graduated 9-inch thermometer, in rubber lined brass case (for testing oils), 3.25.
One worn-out anemometer spindle.
Books and other publications have been received and placed in the library of the Board (during the year ending Sept. 30, 1886), as follows:

BY PURCHASE.

Burial Reform and the Disposal of the Dead in and around Liverpool. Past, Present and Future.—Lowndes.
Cholera: How to prevent and resist it.—Dr. Max Von Pettenkofer.
Cinquieme Congrès International D'Hygiene et de demographie a la Haye.—Tome, II., 1884.
Climate of Canada and its relations to Life and Death.—Hingston.
Dublin Journal of Med. Sciences.
Encyclopedia Britannica, Vols. XIX and XX.

Guide to Sanitary House Inspection; or Hints regarding the Choice of a Home.

Laws and Mechanics of Circulation, Principal involved in Animal Movement.

Manual of Microscopical Technology for use in Investigations of Medicine and Pathological Anatomy.—Friedlander.

Medical and Surgical Directory of the United States.

What is malaria? And why is it most intense in hot climates?—Oldham.

Sanitary Systems showing how the dead should be disposed of by Nations who study the Interests of their Peoples.—Martin.

Supplement to Forty-fifth Ann. Rep. of Registrar Gen. of Births, etc., in Eng.

Transactions of Cremation Soc. of Eng., containing speeches in Parliament upon Cremation, 1884.

Trans. of Sanitary Institute of Great Britain, 1884-5.

Vorlesung über Specielle Pathologie und Therapie.—Liebermeister.

Vorlesungen über Bacterien.—A. de Bary.

Vorlesungen über Specielle Pathologie und Therapie, Infectionskrankheiten.

Vital Statistics: Memorial Selections from Writings of Wm. Farr, M. D., etc.

Wood's Medical Library: Human Osteology; Treatise on Asiatic Cholera; Climatology and Mineral Waters of U. S.; Epilepsy and other Chronic Convulsive Diseases; Their Causes, Symptoms and Treatment; Poisons, Their Effects and Detection, Vols. I. and II.; Wasting Diseases of Infants and Children; Diagnosis of Diseases of Brain and Spinal Cord; Specific Diseases of the Lungs; Renal and Urinary Affections; Kirke's Hand Book of Physiology, Vols. I. and II.; Index to Wood's Library of Med. Authors.

Medical Record, New York.

Lancet, Detroit.

Official Postal Guide.

Scientific American and Supplement.

Sanitary Engineer, New York.

American Journal of the Medical Sciences.

Popular Science Monthly.

Lancet, London.

Nature, London.

British Medical Journal, London.

Sanitary Record, London.

Revue d' Hygiene, Paris.

Sanitary Journal, Glasgow, Scotland.

Science, New York.

Practitioner, London.

Comptes Rendus, Paris.

American Meteorological Journal.

Archiv für Hygiene, Munich.

Berliner Klinische Wochenschrift.

Central blatt für allgemeine Gesundheitspflege.

Received in exchange for Publications of this Board the following Periodicals (in some instances incomplete volumes):—

Agricultural College Bulletin, Lansing, Mich.

Alabama Weather Service.

Analyst, New York.

American Inventor, Cincinnati.

American Exchange and Review, Philadelphia.

American Monthly Microscopical Journal, New York.

American Grocer, New York.

American Observer and Medical Monthly, Detroit.

American Practitioner and News, Louisville.

Annals of Hygiene, Philadelphia.

Babyhood, New York.

Boletin Mensual, Spain.

Buffalo Medical and Surgical Journal.

Building, New York.

Bulletin de l'Academie Royale de Medicine de Belgique.

Bulletin Hebdomadaire de Statistique Demographique et Medicale, Havre.

Bulletin Mensuel du Bureau de Démographie, Marseilles.

Bulletin de la Societe des Creches.

Bulletin New England Meteorological Society.

Calcutta Health Officer's quarterly Rep.

Canada Lancet, Toronto.

Canada Med. and Surg. Journal.

Canadian Practitioner, Toronto.

Chicago Med. Journal and Examiner.

Cincinnati Lancet and Clinic.

College and Clinical Record, Philadelphia.
Columbus Medical Journal, Columbus, O.
Crop Prospects, Illinois.
Daniel's Medical Journal, Texas.
Druggists' Circular, New York.
Ephemeris, Squibbs, Brooklyn, N. Y.
Georgia Crop Report.
Good Health, Battle Creek.
Herald of Health, New York.
Hygiene Pratique, Paris.
Ill. Monthly Weather Review.
Indicator, Detroit.
Journal of Am. Med. Ass'n, Chicago.
Journal d' Hygiene, Paris.
Journal Franklin Institute.
Louisiana State Weather Service Report.
Leonard's Illus. Medical Journal.
Manitoba Crop Bulletin.
Missouri Weather Service.
Minnesota State Weather and Crop Report Service.
Medical and Surgical Journal, Buffalo.
Medical News, Louisville, Ky.
Microscopical Bulletin, Philadelphia.
Manadsofversigt af Vaderleken i Sverige.
Manufacturer and Builder.
Maryland Medical Journal, Baltimore.
Medical Age, Detroit.
Medical Bulletin, Philadelphia.
Medical Chronicle, Baltimore.
Medical Counselor, Grand Rapids.
Medical News, Philadelphia.
Metal Worker, New York.
Michigan Crop Report.
Mississippi Valley Medical Monthly.
Modern Crematist, Lancaster, Pa.
Monatshefte zur Statistik des deutschen Reichs.
Naradno Zdravly, Belgrade, Servia.
National Druggist, St. Louis.
New York Medical Abstract.
New York Medical Journal.
Nashville Journal of Medicine and Surgery.
North Carolina Med. Journal, Wilmington.
Northwestern Lancet, St. Paul, Minn.
Ohio Meteorological Bureau.
Ontario Monthly Health Bulletin, Toronto.
Philadelphia Medical Times.
Physician and Surgeon, Ann Arbor.
Public Health in Mines.
Popular Science News and Boston Journal of Chemistry.
Pharmaceutische Rundschau, New York.
Pharmacist, Chicago.
Quarterly Journal Royal Meteorological Society.
Quarterly Return of Marriages, Births and Deaths in Ireland.
Salford Health Bulletin.
Sanitary Monitor, Richmond, Va.
Sanitarian, New York.
Sanitary News, Chicago.
Sanitary Era, New York.
St. Louis Medical Journal.
Tablettes Mensuelles.
Texas Courier-Record of Medicine, Fort Worth, Texas.
Tennessee Crop Report and Weather Service.
Therapeutic Gazette, Detroit.
Vaccination Inquirer, London.
Veröffentlichungen des Kaiserlich Deutchen Gesundt.
Veröffentlich. des Statistischen Amts der Stadt, Berlin.
Weather Review, Monthly, Washington.
Weekly Drug News, New York.
Weekly Medical Review, Chicago.
Weekly Return of Births and Deaths in Dublin.
Zymotechnic Magazine.

By Gift, Exchange, etc. (*Names and Addresses of donors being printed in Italics*):

Abbott, M. D., S. W., Boston, Mass.:—
6th Ann. Rep. of Mass. Board of Health.
Act to Protect Purity of Inland Waters of Mass.: also, circular concerning proposed work of Board.
Forty-third Registration Rep., Mass.
Suggestions for Preventon of Typhoid fever.
Rep. of Com. on Pub. Health, concerning Poisonous Wall-paper to Mass. House of Rep.

Adams, Miss Rose, London, Eng.:—
Ann. Rep. of Ladies' Sanitary Assoc., 1886.

Allen, M. D., Nathan, Lowell, Mass.:—
Normal Standard of Physiology.
Laws of Inheritance.
The Decadence of the Family.

Andrews, L. F., Des Moines, Ia.:—
Report of Board of Health of Ia., 1885.

Ashmun, M. D. G. C., Cleveland, Ohio:—
Ann. Rep. of Cleveland Health Dep., 1885.

Baird, M. D., J. B., Atlanta, Ga.:—
Ann. Rep. of Atlanta B'd of Health, 1885.

Baird, Spencer F., Washington, D. C.:—
Ann. Rep. of Smithsonian Institute, 1884.

Baker, M. D., Henry B., Lansing, Mich.:—
Climate and health in Mich. Baker.
Rep. of Com. on Disinfectants of Am. Public Health Assoc.
31 Diagrams illustrating a paper on Causation of Pneumonia. Henry B. Baker, M. D.
Notes on Relations of Rainfall and Water-Supply to Cholera.
Ann. Rep. of Lansing B'd. of Water-Commissioners, 1886.

Infectious Diseases in their relations to Public Schools.
Six Diagrams Relative to Cholera and Rainfall in India.
National Conference of State B'ds of Health, Rep. from 7th Ann. Report of Ill. State B'd of Health.
Barwick, Serg. Jas. A., Sacramento, Cal.:—
Meteorology and Climatology of Great Valleys and Foothills of Cal. from 15 to 36 yrs.
Bidenkap, Dr., Christiana, Norway:—
Beretning om Folkemængden og Sundhedstilstander i Christiania i Aaret 1884.
Billings, M. D., J. S., Washington, D. C.:—
Index Catalogue of the Library of Surg. Gen.'s Office, U. S. A., Vol. VII.
Blanford, Henry F., Calcutta, India:—
Rep. on Meteorology of India, 1883.
Meteorological Observations at six stations in India, 1883.
Rep. on Meteorological Dep. of India, 1884–5.
Böckh, Dr., Berlin, Germany:—
Statistisches Jahrbuch der Stadt Berlin, 1883.
Böhmert, Dr., Victor, Dresden:—
Kalender für das Königreich Sachsen, 1886.
Zeitschrift des K. Sächsichen Statistischen, Bureaus, 1885, Heft I. und II.
Boyd, M. D., S. B., Knoxville, Tenn.:—
Ann. Rep. of Sec. of Knoxville B'd of Health and Reg. of Vital Statistics 1885.
Brewer, W. H., New Haven, Conn.:—
Sanitary Science Syllabus of Topics for use in Sheffield Scientic School.
Milk for Cities; Its Production and Care.
Right and Expediency of Public Vaccination.
Sanitation on the Farm.
Browne, John M., Washington, D. C.:—
Rep. of Sec. of Navy, Vol. II. 1883, Vol. II. 1884.
Browne, John S., New York City:—
Ann. Rep. of N. Y. Assoc. for improving condition of Poor, 1886.
Bryce, M. D., P. H., Toronto, Ont.:—
Ann. Rep. of Ontario B'd of Health 1885.
Rep. on Quarantine System of St. Lawrence, 1886.
Buchanan, M. D., Geo., London, Eng.:—
Ann. Rep. of Local Government B'd, 1884–85.
Buck, M. D., E. W., Oakland Cal.:—
Ann. Rep. of Health Officer of Oakland, 1885.
Burrows, Acton, Winnipeg, Manitoba:—
Manitoba Health Service. Dep. of Agriculture.
Manual of Acts and Orders in Council, Relative to Dep. of Agriculture, etc., of Manitoba, 1885.
Statutes of Manitoba passed in 1885.
Burrows, J. G., Melbourne, Australia:—
Ann. Rep. Australian Health Soc., 1885.
Health Lectures for the People, Australian Health Soc.
Bush, M. D., L. P., Wilmington, Del.:—
Resuscitation of the Drowned, L. P. Bush, M. D.
Cabell, M. D., J. G., Richmond, Va.:—
Ann. Rep. of Richmond B'd of Health, 1885.
Cable, F. S., Chicago, Ill.:—
A New School Physiology, Dunglison.
Elementary Physiology, with special reference to Hygiene, Dunglison.
Campbell, A. M., M. D., F. R., Buffalo, N. Y.:—
Relation of Meteorology to Disease.
Canniff, M. D., Wm., Toronto, Ont.:—
Ann. Rep. of Toronto B'd of Health, 1885.
Carroll, M. D., A. L., Albany, N. Y.:—
Duties of Health Officers relative to the prevention of Small-pox. N, Y. B'd of Health circular.
Chambers, J. H. & Co., St. Louis, Mo.:—
Essentials of Vaccination.
Chancellor, M. D., C. W., Baltimore, Md.:—
Laws of Md. relating to Public Health, 1886.
Chapin, Chas. V., Providence, R. I.:—
Ann. Rep. of Supt. of Health of Providence, R. I., 1885.
Chief of Bureau of Statistics, Washington, D.C.:—
Quarterly Reps. of Chief of Bureau of Statistics relative to Imports, Exports, and Immigration. For Quarters ending Sept. 30, Dec. 31, 1885, and March 31, 1886.
Chief Enginer, Washington, D. C.:—
Ann. Rep. of Surveys of Northern and Northwestern Lakes.
Clark, J. M., Denver, Col.:—
Colorado Horticultural Report, 1885, Vol. II.
Clark, M. D., R. D., Albany, N. Y.:—
2d Ann. Rep. of N. Y. Dairy Commissioner, with accompaning Documents.
Cochran, Prof. C. B., West Chester, Pa.:—
Agriculture of Pennsylvania.
Cochran, M. D., Jerome, Montgomery, Ala.:—
Rep. of Ala. Board of Health, 1883–84.
Colman, Norman J., Washington, D. C.:—
Ann. Rep. of Bureau of Animal Statistics, 1885.
Conant, Harry A., Monroe, Mich.:—
Public Acts and Joint and Concurrent Resolutions of Mich. Leg. of 1885, with an appendix.
Mich. Ann. Registration Reps., 1883–1884.
House Journal, 1885, Vols. I. and II.
Senate Journal, 1885, Vols. I. and II.
Local Acts, Session of 1885.
Conn, M. D., G. P., Concord, N. H.:—
Transactions of the N. H. Med. Soc., 1885.
Connor, Rev. Rowland, East Saginaw, Mich.:—
Unity Church-Door Pulpit, Prison Discipline.
Cottell, M. D., H. A., Louisville. Ky.:—
Esthetics of Medicine, Doctorate Address, Louisville University.
Covernton, M. D., T. S., Montreal:—
An Act Respecting the Public Health, Chap. 38.

Regulations of Quebec (Prov.) B'd of Health in the matter of Small-Pox.
An Act Regarding the Public Health, Chap. 45.
Craig, G. G., Rock Island, Ill.:—
Ann. Reps. of City Officers of Rock Island, 1886.
Cregier, D. W. C., Chicago, Ill.:—
Tenth Ann. Rep. of Chicago Public Works Dep. 1885.
Crunden, Frederick M., St. Louis, Mo.:—
Ann. Rep. of St. Louis Public Library, 1884-85.
Cunningham, Dr. Jas. M., Calcutta, India:—
Twentieth Ann. Rep. of Sanitary Commissioner, India.
Twenty-first Ann. Rep. of Sanitary Commissioner, India.
Davis, W. M., Cambridge, Mass.:—
Methods of Study of Thunder-Storms.
Studies of Thunder-Storms in Europe, 1st and 2d paper.
Thunder-Storms in New England in summer of 1885.
Dawson, Jr., M. D., J. L., Charleston, S. C.:—
Transactions of the S. C. Med. Assoc., 36th Ann. Session.
Transactions of S. C. Med. Assoc., 1885.
Dearing, H. P., Chicago, Ill.:—
Rules relative to transportation of Dead Bodies over the M. C. Railroad.
De Wolf, M. D., Oscar C., Chicago, Ill.:—
Rep. of Health Dep. of Chicago, 1885.
Dight, M. D., Prof. C. F., Beirut, Syria:—
Sanitary Progress, Paper read before the Beirut Literary Soc., 1886.
Draper, Ph. D., Daniel, N. Y. City, N. Y.:—
Rep. of N. Y. Meteorological Observatory, 1885-1886.
Draper, M. D., J., Brattleboro, Vt.:—
Insanity in Vermont, 1835-1885. J. Draper, M. D.
Duffield, M. D., Geo., Detroit, Mich.:—
Transactions of Mich. Med. Society, 1886.
Dunwoody, W. P., Washington, D. C.:—
Ann. Rep. of National B'd of Health, 1885.
Durand-Claye, M. Alfred, Paris, France:—
Prefecture du départment de la Seine. Direction des Travaux de Paris. Commission Technique de L'Assainissement de Paris.
Résolutions voteés par La Commission Technique d L'Assainissement de Paris et Résumé des Travaux de La Commission.
Prefecture du Departement de la Seine.
Assainissement de la Caserne de la Cite a Paris.
Mémoire sur L'Assainissement de La Seine.
Mémoire sur L'Assainissement de Berlin.
Assainissement de Paris. Observations des Ingeniéurs du Service Municipal de Paris an Sujet des Projets de Rapport-Présentés par Mm. A. Girard et Bronardel.
L'Assainissement Interieur et Exterieur de la Ville de Berlin.
Nouveau Programme de L'Assainissement de Paris.
Conference faite an Seige de la Societe par M. A. Durand-Claye.
Mémoire sur le Dessechement du Lac Fucind.
Installations D'Ecoulements Directs a L'Egout Service D'Assainissement de la Seine.
Congrés International D'Hygiene de la Haye 2d Section. Samedi 23 août 1884. Le Nouveau Programme D'Assainissement de Paris.
Latrines Publiques et Prures avec Ecoulement Direct a L'Egout a Paris.
Nouveaux Types de Latrines Publiques et Privées avec Ecoulement Direct a L'Egout. Systéme. Durand-Claye.

Durell, M. D., T. M., Somerville, Mass.:—
7th and 8th Ann. Reps. of B'd of health of Somerville, Mass.

Engleman, Dr. Geo. J., St. Louis, Mo.:—
Notes on Gynecology and Obstetrics.
New Departure in Uterine Therapeutics. The dry treatment.
Everts, M. D., Orpheus, Cincinnati, O.:—
Ann. Rep. of Supt. of Cincinnati Sanitarium, 1885.
Overwork as related to Insanity.

Faville, Prof, G. C., Fort Collins, Col.:—
Rep. of Veterinary Dep. of Col. Agricultural Coll.
Fisher, M. D., Chas. H., Providence, R. I.:—
Ann. Rep. of R. I. B'd of Health, 1885, including Rep. on Births, etc., for 1884.
Twenty-ninth Registration Rep. of R. I., 1881; thirtieth, 1882; thirty-first, 1883.
Foster, M. D., Eugene, Augusta, Ga.:—
Ann. Reps. of B'd of Health of Augusta, 1884 and 1885.
Foster, Prof. J., Amsterdam, Holland:—
Bijdrage tot de Kennis vanhet Ruimwater van Schepen. Academisch Proefschrift ter Verkrijging van den Graad van Doctor in the Geneskunde van de Univesiteit van Amsterdam.
Fraser, M. D., H. D., Charleston, S. C.:—
Ann. Rep. of S. C. B'd of Health, 1885.
Gerry, L. L., Stoneham, Mass.:—
Rep. of Commission on System of Drainage for Mystic, Blackstone, and Charles Rivers, Mass.
Gerhard, Wm. Paul, New York City, N. Y.:—
Plea for Sanitation in Factories and Workshops.
Gihon, A. M., M. D., A. L., Washington, D. C.:—
Address by A. L. Gihon, M. D.,—On The Dignity and Importance of the Individual.
What is Medicine? Address before Am. Academy of Med., 1885.
Gold, T. S., West Cornwall, Conn.:—
Ann. Rep. of Conn. B'd of Agriculture, 1885.

Gray, Henry R., Montreal, P. Q.:—
Act for Preservation of Public Health. By-laws of Central B'd of Health.
Rapport du Soms Comite du Conseil d'Hygiene de Montreal sur L'Origine de l'Epidemie de la Variole.
Rep. of Sub-Committee on Origin of the Small-Pox Epidemic.

Gray, S. M., Providence, R. I.:—
Rep. showing Location of Main and Intercepting Sewers of Providence, and other Information, 1884.
Ann. Rep. of R. I. B'd of Charieties and Cor., 1885.

Grimshaw, Thomas W., Dublin, Ireland:—
Ann. Rep. of Registrar Gen. of Ireland, relative to Births, Marriages and Deaths, 1885.

Hardy, A. S., Toronto, Ont.:—
Rep. relating to Registration of Births, etc., in Ont., 1884.

Hardy, M. D., Milton H., Provo City, Utah:—
Preventable-Disease Circulars, Diphtheria, Utah Co.
Preventable-Disease Circulars, Scarlet Fever, Utah Co.

Hazlewood, Arthur, Grand Rapids, Mich.:—
Bericht über die am 13 Jänner 1886 stattgehabte Berathung über die Abhaltung eines Internationalen hygienischen Congresses, 1886, Wien.

Hazen, Gen. W. B., Washington, D C.:—
Ann. Rep. of Chief Signal Officer of Army, 1884.
Signal Service No. XXIII.
Cold Waves and their Progress.

Hemenway, A. M., M. D., H. B., Kalamazoo, Mich :—
Diphtheria in Kalamazoo, Mich.

Herrick, M. D., S. S., New Orleans, La.:—
Bienn. Rep. of La. B'd of Health, 1884-85.

Hibbard, M. D., Jas. F., Richmond, Ind.:—
Sanitary Conditions and Necessities of School Houses and School Life.

Hiltebrant, E., Philadelphia, Pa.:—
Official Catalogue, "Novelties" Exhibition, Philadelphia.
Catalogue of Memorial Library of International Electrical Exhibition, 1884.
Constitution and Regulations, for the Committee of the Franklin Institute, on Science and Arts.
List of Duplicates in Library of Franklin Institute.

Hinrichs, Dr. Gustavus, Iowa City, Ia.:—
Documents and Data relating to Condemnation of Flour and the Persecution of a Chemical Expert.
Address delivered at opening of Pharmacy Department of the Iowa University, 1885.
Chronological List of Scientific Books and Papers.

Holmes, Howard M., Lansing, Mich.:—
Circular of Bureau of Education relative to Physical Training.
3d Ann. Rep. of U. S. Civil Service Commission, 1885.

Horlbeck, M. D., H. B., Charleston, S. C.:—
Ann. Rep. of Health Dep. of Charleston, 1885.

Howell, E. A., Reading, Pa.:—
Rep. of Reading B'd of Health, 1885.

Hunt, M. D., E. M., Trenton, N. J.:—
Laws relating to Public Health N. J.
Circular relating to Adulteration of Foods or Drugs, and to Petroleum, N. J. B'd of Health.
Circular of N. J. B'd of Health to Physicians.
Ann. Rep. of N. J. B'd of Health and Bureau of Vital Statistics, 1885.

Jamieson, T. N., Chicago, Ill.:—
Ann. Rep. of B'd of Pharmacy of Ill., 1885.

Janssens, Dr. E., Brussels, Belgium:—
Ville de Bruxelles Annuaire Démographique et Tableaux Statistiques des Causes de Deces.

Jones, M. D., E. U., Taunton, Mass.:—
Ann. Rep. of Taunton B'd of Health, 1885.
Ann. Reps. of Taunton B'd of Health, 1883, 84.

Kimball, Sumner, I., Washington, D. C.:—
Ann. Rep. of U. S. Life-Saving Service, 1885.

Koninklijk Nederlandsch Meteorologisch Institute, Utrecht, Netherlands:—
Nederlandsch Meteorlogisch Jaarboek voor, 1885.

Kraus, Dr., Bremen, Hamburg:—
Bericht des Medicinal-Inspectorats über die Medicinische Statistik des Hamburgischen Staates, 1885.

Kuborn, Dr., Brussels, Belgium:—
Congrès National Scientifique Prophylaxie des Maladies Pestilentielles Exotiques.
Bulletin de la Societe Royale de Medecine Publique du Royaume de Belgique.

La Du, S. W., Coral, Mich.:—
Rep. of Mich. Inspector of Illuminating Oils, 1885.

Launay, Dr. A., Havre, France:—
Ville de Havre-Bureau Municipal D'Hygiene-Rapport du Directeur sur les Operations, 1884.

Leffman, M. D., Henry, Philadelphia, Pa.:—
Typhoid Fever in Philadelphia, Henry Leffman, M. D.

Lee, M. D., Benj., Philadelphia, Pa.:—
Precautions against Small-Pox, No. 8.
Constitution and By-Laws of Pa. B'd of Health.
Rep. of Organization of Pa. B'd of Health, and minutes of First and Second Meetings, 1885.
Rules for Local B'ds of Health of Pa.
Sanitary Regulations relative to Traffic and Travel.
Precaution against Cholera, No. 7.
Act to Establish B'd of Health for Pa.
Address of State B'd of Health to the People of Pa.

Regulations of Pa. State B'd of Health, to prevent Slaughter-Houses, etc., from becoming prejudicial to Public Health.
Organization of Local B'd's of Health in Pa.
LeHardy, M. D., J. C., Savannah, Ga.:—
Syphilis—Importance of thorough diagnosis and long-continued treatment.
Ann. Address before Ga. Med. Assoc., 1881.
National Sanitation, J. C. LeHardy, M. D.
On Yellow and Break-Bone Fevers, Prof. LeHardy, M. D.
Letchworth, Wm. P., Portageville, N. Y.:—
Children of the State, Address delivered at National Conference of Charities and Corrections, 1886.
Lindsley, M. D., C. A., New Haven, Conn.:—
Prevention of Small-Pox in Connecticut, Circular to Health Officers, No. 19.
A Letter from the Sec. of the State B'd of Health, to Selectmen of Towns and Local B'ds of Health.
Ann. Rep. of New Haven B'd of Health, 1885.
Ann. Rep. of Conn. B'd of Health, 1885.
Linsley, M. D., Jo. H., Burlington, Vt.:—
Ann. Rep. of Health Officer of Burlington, 1885.
Long, M. D., John H., Chicago, Ill.:—
Bulletin of Ill. Microscopical Soc. relative to Butter.
Some Points on the Micro-Chemistry of Fats.
Ludlow, Wm., Philadelphia, Pa.:—
Ann. Rep. of Philadelphia Water Dep., 1884.
McCutchon, M. D., P. B., New Orleans, La.:—
Transactions of La. Med. Soc., 1886.
McElroy, J. F., Lansing, Mich.:—
Architecture, Heating and Ventilation of Institutions for the Blind. Address by J. F. McElroy.
Mackellar, Chas. K., Sidney, N. S. Wales:—
Australasian Sanitary Conference, 1884.
Rep. to N. S. Wales Legislative Assembly on Wood Pavement Board.
McKeough, M. B., Geo. F., Chatham, Ont.:—
Influence of Malaria and Quinine on Pregnancy and Parturition—G. F. McKeough, M. B.
McPherson, Wm., Howell, Mich.:—
Ann. Rep. of Mich. Commissioner of Railroads, 1885.
Mansfelde, M. D., A. S. V., Ashland, Neb.:—
Proceedings of Neb. Med. Soc., 1885.
Marriott, Wm., London, Eng.:—
List of Fellows of Royal Meteorological Soc.
Marshall, M. D., Wm., Milford, Del.:—
Rep. of Del. B'd of Health, 1885.
Rep. of Del. B'd of Health on Hygiene and Quarantine,
On Domestic Hygiene or Hygiene of Homes.
Martin, M. D., S. C., Roxbury, Mass.:—
Inoculation, etc., of Animal Vaccine.
Means, M. D., Thomas A., Montgomery, Ala.:—
Transactions of Ala. Med. Assoc., 1885 and 1886.
Mell, P. H., Auburn, Ala.:—
Record of the Weather from 1701 to 1885, Ala. Weather Service.
Mercer, M. D., A. Clifford, Syracuse, N. Y.—
Second Ann. Rep. of Syracuse B'd of Health.
Metcalf, M. D., C. N., Indianapolis, Ind.:—
Fourth Ann. Rep. of B'd of Health of Ind., also Rep. of Bureau of Vital and Sanitary Statistics, 1885.
Mich. Board of Health, Lansing, Mich.:—
Prevention of Communicable Diseases, Reprint No. 238.
Ypsilanti Water Supply, Jas. H. Shepard.
Time of Greatest Prevalence of Each Disease in Mich., 1884.
Meteorological Conditions in Mich., 1883.
Prevention of Typhoid Fever, No. 99.
Proceedings of Mich. B'd of Health Jan. 12, 1886.
Proceedings of Ypsilanti Sanitary Convention, 1885.
Influence of Sewerage and Water-Supply on Death Rate in Cities—Erwin F. Smith.
President's Address at Ypsilanti Sanitary Convention.
Sanitary Needs of School Buildings and Grounds—Prof. Austin George.
Proceedings of Sanitary Convention held at Howell, Mich.
Sanitary Work in Small Cities—Bion Whelan, M. D.
Rep. of Proceedings of Mich. B'd of Health, July 13, 1886.
Poisonous Cheese—V. C. Vaughan.
History of Investigations concerning Micro-organisms, and the Germ Theory of Disease—Frank Wells.
Communicable Diseases in Mich. in 1885.
Names and Addresses of Mich. Health Officers, 1886-87.
Testing Illuminating Oils in Mich.
Time of Greatest Prevalence of Each Disease, 1885.
Rules in regard to the Inspection of Travel, for the prevention of the Introduction of Communicable Diseases, No. 95.
Conferences of Representatives of State B'ds of Health 1884, Rep. of Sec. of Mich. B'd.
Health Inspection of Travel by State B'd of Health and U. S. Other Efforts to protect Mich. from Small-Pox.
Duties of Local B'ds of Health, Reprint 239.
Disposal of Slops and Garbage, Reprint 240.
Water Supply, Dr. V. C. Vaughan, Reprint 241.
Millen, D. D., Rev. Chas. W., Brooklyn, N. Y.:—
Address by Rev. Chas. W. Millen, D. D., delivered at 25th Commencement of the Eclectic Med. Coll., N. Y.

Mills, Chas. F., Springfield, Ill.:—
Monthly Weather Reviews for Aug.—Dec. 1885. Ill.
Minister of Agriculture, Rome, Italy:—
Statistica della Opere pie e della Spese di Beneficenza Sostenute dai Comuni e dalle Province Piemonte.
Popolazioné—Movimento dello Stato Civile Anno XXIII, 1884—Introduzione.
Annali di Statistica. Roma. Statistica Industriale. Fascicola 1.
Statistica delle causa di Morte, 1884.
Ministerio de la Gobernacion, Madrid, Spain:—
Direction General de Beneficencia y Sanidad—Resumen General de las invasiones y defunciones por causa de Colera, 1885.
Moore, Robert, St. Louis, Mo.:—
A Sanitary Survey of St. Louis.
Nelson, M. D., E. M., St. Louis, Mo.:—
Milk for Babes, E. M. Nelson, M. D.
Newell, Minor S., Lansing, Mich.:—
Mich. Land Office Rep., 1885.
Newton, M. D., Wm. K., Paterson, N. J.:—
Rep. of B'd of Health of Paterson, 1885–86.
Report of N. J. Milk Inspector.
O'Brien, M. D., J., Calcutta, India:—
Ann. Rep. of Health Officer of Calcutta, 1884.
Olcott, J. B., South Manchester, Conn.:—
The Germ Theory.
Palmer, M. D., A. B., Ann Arbor, Mich.:—
A Treatise on Epidemic Cholera and Allied Diseases.
Palmer, Hon. Thos. W., Detroit, Mich.:—
Dairy Protection, Speech by Hon. T. W. Palmer in U. S. Senate.
Parkill, Stanley E., Owosso, Mich.:—
Proceedings of Mich. Pharmaceutical Assoc., 1885.
Peck, Dr. O. W., Oneonta, N. Y.:—
A few Sanitary Points and their Relations to Farmers' Houses.
Playter, M. D., Edward, Toronto, Ont.:—
Health Rules.
Plummer, M. D., R. H., San Francisco:—
Register of Physicians in Cal., 1885.
Pond, C. V. R., Lansing, Mich.:—
Fourth Con. of Bureaus of Labor Statistics in U. S.
Third Ann. Rep. of Mich. Bureau of Labor and Industrial Statistics, April 1885 to Feb. 1886.
Prendergast, Thos. A., St. Paul, Minn.:—
Ann. Rep. of Health Dep. of St. Paul, 1885.
Rafter, Geo. W., Rochester, N. Y.:—
Fredonia Water-Works. Final Rep. 1885.
Ranney, M. D., Geo. E., Lansing, Mich.:—
Transactions Mich. Med. Society, 1885.
Rauch, M. D., J. H., Springfield, Ill.:—
Proceedings of Ill. B'd of Health, Oct., 1885; March, 1886, and June, 1886.
7th Ann. Rep. of Ill. B'd of Health.
Rep. of Inspection of Atlantic and Gulf Quarantines.
Register of Physicians and Midwives in Ill., 1877–86.
Rep. of Ann. Meeting of Ill. B'd of Health, 1886.
Raymond, Henry S., Lansing, Mich.:—
Ann. Rep. of Mich. Commissioner of Insurance, Part I. and II., 1885.
Raymond, M. D., J. H., Brooklyn, N. Y.:—
Typhoid Fever in Brooklyn, 1885.
Ann. Rep. of Brooklyn Health Dep., 1885.
Rep. of Brooklyn Health Dep., 1878–79.
Redden, M. D., J. W., Topeka, Kan.:—
Ann. Rep. of Kan. B'd of Health, Apr.-Dec., 1885.
Reed, M. D., R. Harvey, Mansfield, Ohio:—
Rep. of Meeting of Ohio Sanitary Assoc., 1886.
Practical Reasons in reference to a State B'd of Health.
Public Health is Public Wealth.
Reeve, M. D., J. T., Appleton, Wis.:—
Letter from State B'd of Health, relative to Small-Pox in Wis.
Rep. of Wis. B'd of Health, 1885.
Rowland, C. W., Cincinnati, Ohio:—
Ann. Rep. of Health Dep. of Cincinnati, 1885.
Russell, Jas. B., Glasgow, Scotland:—
Vital Statistics of Glasgow, Part I. and II., 1885.
Salomon, Dr. L. F., New Orleans, La.:—
B'd of Health Rep. on the Biloxi Fever, 1886.
Plea for Popular Knowledge of Sanitation.
Satterlee, M. S., Prof. James, Lansing, Mich.:—
Ann. Rep. of Mich. Horticultural Soc., 1885.
Saunder, M. D., R. C. Calcutta, India:—
Rep. of Health Officer of Calcutta, first quarter of 1886.
Schreiber, Dr. Paul, Chemnitz, Saxony:—
Jahrbuch des Königl. Sächs. Meteorologischen Institutes, 1884.
Secretary of the Treasury, Washington, D. C.:—
U. S. Coast and Geodetic Survey, 1884.
Shattuck, G. C., Boston, Mass.:—
Med. Communications of Mass. Med. Soc., 1886.
Sherman, Dr. J. J., Martinette, Wis.:—
Statement relative to Small-Pox at Marinette, Wis.
Shurly, M. D., E. L., Detroit, Mich.:—
Rep. on Origin and Distribution of Phthisis Pulmonalis in Mich.
Smead & Co., I. D., Chicago, Ill.:—
Ventilation and Warming of Buildings, Ruttan's System.
Smith, Elder & Co., London, Eng.:—
Diary for 1886, Sanitary Record and London Med. Record.
Smith, M. D., Chas. D., Portland, Me.:—
Transactions of Me. Med. Assoc., 1885.
Smith, M. D., W. M., New York City:—
Disinfection of Rags. Communication to N. Y. City B'd of Health.

Snow, M. D., Edwin M., Providence, R. I.:—
Ann. Rep. on Births, etc., in Providence, 1885.
Original Jennerian Vacine Virus as preserved in Providence, R. I.
Statistisches Amt., Berlin:—
Veröffentlichungen des Statistischen Amts., Berlin, Supplements I. and II.
Die Berliner Volksgählung, 1880. Zweites Heft.
Stearns, M. D., Henry P., Hartford, Conn.:—
Ann. Rep. of Officers of Hartford Retreat for Insane, 1886.
Stevens, W. C., Lansing, Mich.:—
Ann. Rep. of Auditor General of Mich., 1885.
Stevenson, Gen. John D., St. Louis, Mo.:—
Ann. Rep. of St. Louis Health Commissioner, 1885-86.
Stewart, M. D., Jas. A., Baltimore, Md.:—
Ann. Rep. of Baltimore Health Department, 1885.
Stoddard, M. D., J. T., Northampton, Mass.:—
Directions for Victor Kerosene Tester.
Storer, M. D., H. R., Newport, R. I.:—
"A Sea-Change," H. R. Storer, M. D.
Ann. Rep. of Newport Sanitary Protection Assoc., 1884-5.
Rept. of Trustees of Newport Hospital, 1884.
Storrs, L. C., Lansing, Mich.:—
Proceedings of National Conference of Charities and Corrections, 1885.
Proceedings of Conference of County Agents, and Convention of B'd of Cor. and Charities at Big Rapids, 1885.
Proceedings of 4th Ann. Conference of County Agents and Convention of Mich. B'd of Cor. and Charities, 1885.
Proceedings of Ann. Convention of Superintendents of Poor and Union Assoc. of Mich., 1886.
Stowe, E. A., Grand Rapids, Mich.:—
Proceedings of Mich. Dairymen's Assoc., 1886.
Switzler, Wm. F., Washington, D. C.:—
Quarterly Rep. of Ch'f of Bureau of Statistics, Treas. Dep., for quarter ending June 30, 1886.
Taggart, Moses, Lansing, Mich.:—
Ann. Rep. of Mich. Att'y. General, 1885.
Taneyhill, M. D., G. L., Baltimore, Md.:—
Trans. of Md. Med. and Chirurgical Faculty, 1885.
Taylor, M. D., J. Stopford, Liverpool, Eng.:—
Rep. of Health of Liverpool, with Map showing Localities of fatal Fevers, 1885.
Thomas, Benj. F., Columbus, Ohio:—
Ann. Rep. of Ohio Meteorological Bureau, 1885.
Thornton, M. D., G. B., Memphis, Tenn.:—
Ann. Rep. of Shelby County B'd of Health, 1885.
Townshend, M. D., Smith, Washington, D. C.:—
Rep. of Health Officer of D. C., 1885.
Tripe, M. D., J. W., London, Eng.:—
Rep. on Sanitary Condition of Hackney District, 1884.
Tucker, Ph. D., Willis G., Albany, N. Y.:—
Sanitary Value of Chemical Analysis of Potable Waters.
VanSlyke, Prof. L. L., Honolulu:—
Bien. Rep. of Minister of Interior of Sandwich Islands, 1886.
Veenboer, M. D., M., Grand Rapids, Mich.:—
The Sphinx and Riddle. Address by M. Veenboer, M. D.
Wahl, W. H., Philadelphia, Pa.:—
Rep. of Section XXII of International Electrical Exhibition, 1884, Electric Signaling.
Wallace, M. D., David L., Newark, N. J.:—
Ann. Rep. of Newark B'd of Health, 1885.
Walsh, M. D., Ralph, Washington, D. C.:—
Facts about Vaccine and Vaccination.
Waring, Geo. E., Newport, R. I.:—
Rep. of Mass. Drainage Commission.
Watson, M. D., Irving, A., Concord, N. H.:—
Ann. Rep. relative to Births, etc., in N. H., 1884.
Ann. Rep. of N. H. B'd of Health, 1886.
Announcement of Meeting of Am. Public Health Assoc., 1885.
Wawrinsky, Dr. R., Stockholm, Sweden:—
Berättelse till Kongl. Medicinal-styrelsen om Allmänna Hellsotillståndet i Stockholm, 1885.
Welfley, M. D., D. P., Cumberland, Md.:—
Public Health. The Lomb Prize Essays.
Whipple, G. M., Richmond, Eng.:—
History of Kew Observatory.
Rep. of Kew Observatory Committee, 1885.
Wight, M. D., O. W., Detroit, Mich.:—
Ann. Rep. of Detroit B'd of Health, 1885-86.
Wilkins, M. D., Geo., Montreal, P. Q.:—
Is Pneumonia Infectious?—Geo. Wilkins, M. D.
Wing, Asa S., Philadelphia, Pa.:—
Mortality Experience of Provident Life and Trust Co., 1866-1885.
Wolf, Dr. T. R., Newark, N. J.:—
Ann. Rep. of State Chemist to Governor of Del.
Wright, Carroll D., Washington, D. C.:—
1st Ann. Rep. of Labor Commissioner. Industrial Depressions.
17th Rep. of Bureau of Labor Statistics, Mass.
Wyeth, John and Brother:—
Vaccine Propagating Establishment, etc.
Young, M. D., A. G., Augusta, Me.:—
Does Vaccination Protect?
Construction and Management of Earth-Closets.
Rules for Local B'ds of Health in Maine.
Practical Facts about Cholera.
Hints on Building School-Houses.
Scarlet Fever, Its Prevention and Restriction.
Small-Pox, Its Prevention and Restriction.
Typhoid Fever, Its Prevention and Restriction.
Diphtheria, Its Prevention and Restriction.
Ann. Rep. of Me. B'd of Health, 1885.
Abstract of Me. Health Laws, 1886.
Young, Wm., London, Eng.:—
Read and Think, 1885,
Mitigation Theory of Vaccination. Milnes.

WEEKLY OR MONTHLY MORTALITY STATEMENTS.

These have been received during the past year from health officers, registrars, officers of Boards of health, or of cities in the United States or foreign countries, as follows:

Abbott, M. D., S. W., Health Officer, Department of Health, State House, Boston, Mass.
Ashmun, M. D., G. C., Health Officer, Cleveland, Ohio.
Baldwin, Cyrus W., Registrar, Paterson, N. J.
Bidenkap, Dr. chef del Administration Sanitaire, Christiana, Norway.
Boyd, Geo., Registrar Vital Statistics, Paterson, N. J.
Boyd, M. D., S. B., Secretary Board of Health, Knoxville, Tenn.
Briggs, M. D., Albert H., Health Physician and Registrar of Vital Statistics, Buffalo, N. Y.
Buck, M. D., E. W., Health Officer and City Physician, Oakland, Cal.
Bureau d'Hygiene, Havre, France.
Bureau de Demographie et de la Statistique Medical de la Ville, Marseilles, France.
Cabell, M. D., J. G., Pres't Board of Health, Richmond, Va.
Carroll, M. D., Alfred L., Sec. State B'd of Health, Albany, N. Y.
Carson, M. D., Gib. W., Clerk, Health Com'r, and Board of Health, St. Louis, Mo.
Carter, A. Robert, Sec. City Board of Health, Baltimore, Md.
Cargill, H. N., Clerk of Board of Health, Grand Rapids, Mich.
Cocchi, A. Il Direttore, Dell' Officio di Statistica e Stato Della citer di Roma, Rome, Italy.
Day, M. D., Walter De F., Sanitary Supt. and Registrar, N. Y. City.
Det. Kgl. Sundheds Collegium, Copenhagen, Denmark.
Fraser, M. D., E. B., Registrar, Wilmington, Del.
Fuchs, Dr. J. M., Secretaris Commissie van Toezicht op den Stedelyken Geneeskundigen Dienst, Amsterdam, Netherlands.
Galt, M. D., James D., Health officer, Norfolk, Va.
Gleason, M. D., M. K., Registrar Vital Statistics, and DeWolf, M. D., O. C., Health Officer, and Tomlinson, A. M., M. D., Registrar Vital Statistics, Chicago, Ill.
Grimshaw, M. D., Thomas W., Registrar General, Dublin, Ireland.
Horlbeck, M. D., H. B., City Registrar, Charleston, S. C.
Holt, M. D., Joseph, President State Board of Health, New Orleans, La.
Hoyt, Henry F., Health Officer, Jones, Talbot, Health Officer, St. Paul, Minn.
La Rocque, M. D., A. B., Medical Health Officer, Montreal, P. Q.
Lindsley, M. D., C. A., Health Officer, New Haven, Conn.
Linsley, M. D., J. H., Health Officer, Burlington, Vt.
Martin, M. D., R., Commissioner of Health, Milwaukee, Wis.
Mitchell, M. D., Chas., Health Officer and Registrar, Nashville, Tenn.
Robinson, M. D., D. E., Health Officer, Manistee, Mich.
Rouse, M. D., J. S., Health Officer, East Saginaw, Mich.
Scales, M. D., T. S., Health Officer, Mobile, Ala.
Snively, M. D., W., Registrar, Pittsburg, Penn.
Snow, Edwin M., Supt. of Health, Providence, R. I.
Statistisches Amt der Stadt Berlin, Berlin, Germany.
Tatham, M. D., John, Medical officer of Health, Salford, England.
Townsend, M. D., Smith, Health Officer and Registrar, Washington, D. C.
Tyrrell, M. D., G. G., Sec. State Board of Health, California.
Watkins, R. N., City Sexton, Lansing, Mich.
Wheeler, M. D., John B., Health Officer, Burlington, Vt.
Wight, M. D., O. W., Health Officer, Detroit, Mich.
Wyckoff, M. D., R. M., Registrar of Records, Brooklyn, N. Y.

Excepting certain publications drawn out by members of the board and others, the foregoing, together with those accounted for at date of the last annual report as in the library, or drawn out, are in the library in good condition. Those drawn out, and not yet returned, are as follows:

BY HOMER O. HITCHCOCK, M. D.

Memoirs on Diphtheria, Library No. 716.
Prevention of Cholera Infantum and Kindred Disorders, No. 1528.

BY REV. D. C. JACOKES, D. D.

Report Mass. Board of Education on proposed Survey of the Commonwealth, No. 869.

Memorandum of Am. Pub. Health Ass'n, on Legislation affecting the Public Health, No. 1750 (1255).
Circular of inquiry by Wis. State Board of Health, to School Teachers, and circular to county supts., transmitting the same for distribution.

BY HENRY F. LYSTER, M. D.

Separate System of Drainage, No. 326.
Public Health, June 9, 1876.
Uppingham By-Laws and Regulations on House Drainage, No. 966.
October, Nov., and Dec. Nos. of Plumber and Sanitary Engineer.
Statement of Objects of Sanitary Protection Association, Edinburgh.
Statement of Objects of Sanitary Protection Association, Newport, R. I., No. 1359.
Circular from Mass. State Board of Health, on Drainage, etc., No. 1367.
Twelve Photographs, illustrative of Influence of Climate on Phthisis and Rheumatism, No. 1595.
Circular on "House Drainage," Mass. State Board of Health, No. 1599.
Playter's Elementary Anatomy, Physiology, and Hygiene, No. 1762.
Dangers to Health, T. Pridgin Teale.
American Sanitary Engineering, Philbrick, No. 2471.
Sewerage and Sewage Utilization, Corfield, No. 119.
Construction and Management of Earth Closets, No. 5244.
Report of Com. on Construction and Management of Privies (N. O. Aux. San. Association, 1880), No.
The Pneumatic Sewage System, Zehfuss, No. 116.
Illustration of the Durham System of House Drainage, No. 4034.
Atlantic Monthly, Oct., 1875, No. 1606.
House Drainage, Gerhard, No. 4039
The Separate Versus the Combined System of Sewerage, No. 5009.
The Pullman Sewerage, Williams, No. 5008.
Report on Saginaw Sewerage, Williams, No. 5011.
Sewerage and Sewage Disposals at Providence, R. I., Waring, No. 4784.
Drainage and Sewerage at Hyde Park, Ill., No. 5008.
Report of the Mass. Drainage Commission, Waring, No. 5394.
Plan of Sewerage for Baltimore City, No. 2675.
Regulations governing Plumbing, etc., Baltimore, Md., No. 3940.
The Sanitary Record (4 Nos.), July 15, Aug. 15, 1885, Jan. 15, Mar. 15, 1886.

BY JOHN H. KELLOGG, M. D.

Nat. Board of Health Bulletin Sup., No. 7, 1880, and No. 17, 1882, Nos. 3840, 3841.
Collective Investigation of Diphtheria, No. 3842.
Glasgow Sanitary Journal, Nov. 10, 1884.

BY HENRY B. BAKER, M. D.

Journal of Hygiene, for Sept. 1, 1881.
Trans. Med. Chir. Soc., London, Vol. 35, No. 2642.
N. Y. Med. Abstract, April, 1883.
College and Clinical Record, May 1, 1884.
The Typhoid Fever of America, No. 3905.
Jour. Franklin Institute, Nov. 1884.
Buffalo Med. and Surg. Journal, Aug. 1885.

BY HON. LEROY PARKER.

An Ordinance Relative to the Appointment and Duties of the City Physician of West Bay City, No. 1760.
Sanitary Chart on Management of Infants, No. 2515.

BY MISS F. E. BABBITT.

Women, Plumbers and Doctors, No. 4888.
Circular of Information of Bureau of Education, No. 1, 1879, No. 1938.
Jour. of Cong. and Exhib. of San. Inst. G. B. 1877, No. 1088.
Reports of Ladies' San. Association, 1880, 1881, 1882, 1883, 1886; Nos. 2401, 2460, 2945, 3581, 5428.

BY GEO. E. RANNEY, M. D.

Physician and Surgeon, August, 1885.

BY BELA COGSHALL, M. D.

Scientific American, July 5, 1879.

BY JOHN AVERY, M. D.

Trans. Mich. Med, Society, 1874, No. 73.
Am. Pub. H. Ass'n, Vols. IV, V, and VI, Nos. 3236, 3237, 3238.
British Medical Journal, Vol. 2, 1884, Vol. 1, 1884, Jan.—June, 1883, Nos. 5104, 4483, 3874.
London Lancet, July—Dec., 1882, and Jan.—June, 1883, Nos. 3724, 3879.
Popular Science Monthly, Vol. 25, May—Oct., 1884, No. 4831.
Floating Matter of the Air—Tyndall, No. 2603.
Scientific American Supplement, Vols. 17, 13, 15, 18, 12, 14, Nos. 3378, 4462, 3884, 5116, 3195, and 3725.
5th Annual Report of State Board of Health of Conn., year 1882, No. 3503.
New York Medical Abstract, July, 1886.

BY C. C. YEMANS, M. D.

Report on Plans for Securing Records of Deaths, Harris, No. 1703.
State Boards of Health, etc., Stevens, No. 3395.
Some Fallacies of Statistics, Rumsay, No. 678.
Death Rate of Each Sex in Michigan, Baker, No. 538.

BY HON. W. W. ROOT, M. D.

Sanitary Work in Lansing, Mich., No. 2031.
Mayor's Address, Aurora, Ill., 1879, No. 1414.

BY FOSTER PRATT, M. D.

National Board of Health Report, 1885.

BY HERMAN OSTRANDER, M. D.

Human Body, Martin, No. 4021.
Handbook of Physiology, Vols. I and II, Nos. 5414, 5415.

BY JOHN P. STODDARD.

Pacific Record of Med. and Pharmacy, Aug. 15, 1886.
Annals of Hygiene, Aug. 1, 1886.
Trans. New York Medical Society, 1883, No. 4266.
Trans. So. Carolina Medical Association, 1884, No. 4362.
Trans. Vermont Med. Society, 1869 and 1870, No. 590.
Trans. New Hampshire Med. Society, 1885, No. 5186.
Trans. New York State Med. Association, 1884, No. 4967.
Weekly Medical Review, Vol. 9, Jan.—June, 1884, No. 4502.
Journal American Med. Association, Vol. 2, 1884, No. 4494.
Poisons, Their Effects and Detection, Blyth, Vols. I. and II., Nos. 5408 and 5409.

BY ARTHUR HAZLEWOOD, M. D.

Responsibility in Mental Disease, Maudsley, No. 178.
Suicide, Henry Morselli, No. 4171.
Marriage of Near Kin, Huth, No. 700.
Observations in reference to duration of life, etc., Hodgson, No. 121.
Fourth Bien. Report of Board of Supervision, Charitable Institutions, No. 1261.
Increase of Human life, Jarvis, No. 800.
Popular Science Monthly, Vol. 14, 1879, No. 1593.
Nature, Vol. XV, No. 1538.
Nature, Jan. 28, 1886.
Heredity, Responsibility in Parentage, Platt, No. 1004.
Daily Sanitary News, May 18.
Trans. American Public Health Association, Vol. I, No. 191.
Trans. American Public Health Association, Vol. II, No. 993.

Diseases of Modern Life, Richardson, No. 1036.
Physical Education, McLaren, No. 3585.
Sound Bodies for our Boys and Girls, Blaikie, No. 4380.
Brain Work and Overwork, Wood, No. 1951.
Longevity, John Gardner, No. 171.
Health and How to Promote It, McSherry, No. 3805.
The Maintenance of Health, Fothergill, No. 160.
Long Life and How to Reach It, Richardson, No. 1954.
Therapeutic Gazette, Aug. 16, 1886.
Cincinnati Lancet and Clinic, Vol. 13, 1884, No. 5120.
Sanitary Journal, Vol. 7, Mar. 1883 to Feb. 1884, No. 4540.
Paper on Adulterations of Groceries, Ellen H. Richards, No. 4104.
American Analyst, Vol. II, Nos. 2, 7, 8, 9, 10, 12, Vol. I, Nos. 24, 23, 10, 8.
New York Analyst, Vol. IX, Nos. 2, 3, 4, 5.
Milk for Cities, Its Production and Care, No. 5446.
Milk for Babes, E. M. Nelson, M. D., No. 5172.
Second Annual Report of the New York State Dairy Convention, No. 5519.
London Lancet, June 26, 1886.
Twenty-sixth Annual Report of the Milk Inspector of Boston, No. 4898.
Report of the Com. on Public Health, N. Y., No. 4876.
Therapeutic Gazette, June 15, 1886, and Nov. 16, 1885.
Report of the Milk Inspector of N. J., No. 5360.
Scientific American, Vol. 51, No. 5115.
Scientific American Supplement, Vol. 16, 1883, No. 4461.
Journal of Franklin Institute, Sept., 1886.

BY M. T. GASS.

Registration of Plumbers, etc., Health Depart. N. Y. City, No. 3215.

BY W. STAGG.

Tornadoes, Their Characteristics, etc., Finley, No. 3028.
Tornado Studies for 1882, Finley, No. 2939.
Tornado of April 14, 1879, No. 1611.
Special Characteristics of Tornadoes, No. 4185.
Meteorological Researches, Part II., Ferrel, No. 2942.
Character of Six Hundred Tornadoes, No. 3230.
Building.

BY BION WHELAN, M. D.

Circular giving notice to householders of presence of contagious disease, and establishing quarantine—issued by Board of Health of St. Clair City, No. 2624.
Health Regulations of Village of Tecumseh.
Orders, Regulations, and Suggestions of the Board of Health of Mount Pleasant, N. Y., No. 4045.
Sanitary Work in the Smaller Towns and Villages, Slagg, No. 657.
Handbook of Rural Sanitary Science, Marsh, No. 650.
Hygeia; A City of Health, Richardson, No. 744.
The Future of Sanitary Science, Richardson, No. 1171.
Maxims of Public Health, Wight, No. 4889.
Dirty Dustbins and Sloppy Streets, Boulnois, No. 4890.
Trans. Sanitary Institute of Great Britain, Vol. V., No. 4672.
New Hampshire State Board of Health Report, 1884 (Vol. 3), No. 4581.
Parkes' Hygiene, Am. Ed., No. 4038.
The Collective Investigation Record, Humphrey, No. 4549.
A History of Tuberculosis, Eric E. Sattler, M. D., No. 3777.
Daniel's Medical Journal (Vol. 1).
The Lancet, No. XXIII., Vol. II., 1885.
Detroit Lancet, June, 1885.
The American Journal of the Medical Sciences, No. 183.
New York Medical Abstract, May, 1883.
The Medical Record, March 20, 1886.

Scientific American, April 3, 1886.
Sanitary Engineer, January 14, 1886.
Philadelphia Medical Times, Vol. 14, 1883-4, No. 4832.
Therapeutic Gazette, Vol. 8, 1884, No. 5098.
London Lancet, July—Dec., 1883, No. 4530.
Medical News, Vol. XLI., No. 3673.
British Medical Journal, July—Dec., 1883, No. 4482.
New York Medical Journal, Vol, 40, July—Dec., 1884, No. 5126.
The Therapeutic Gazette, Oct. 15, 1885.
Jour. Am. Medical Association, July 31, 1886.

BY VICTOR C. VAUGHAN, M. D.

Tenth Annual Report of the Local Government Board, 1880-81, No. 2765.
Le Service Communal de la Desinfection a Bruxelles, No. 4616.
New York Medical Abstract, Sept., 1885.
Leonard's Illustrated Medical Journal, Oct., 1885.
New York Medical Abstract, Nov., 1885.
London Lancet, Aug. 21, 1886.

BY HON. S. W. LADU.

Four pamphlets on Examination of Illuminating Oils, Nos. 2979, 1429, 3656, 1432.

BY A. A. CLARK.

Conference of Charities and Correction, 1885, No. 5310.

L. A. WARSABO, M. D.

Sanitary Record, July, 1882—June, 1883, No. 3939.
Sanitary Record, July, 1883—June, 1884, No. 4532.
The Sanitarian, Vol. 2, 1884, No. 4528.
The Sanitarian, Sept., 1884; Mar., Oct., 1885, and Jan., Feb., May, and June, 1886.
Quarterly Reports of Chief of the Bureau of Statistics, Treasury Dept., Washington, D. C., No. 2, 1884-5, No. 4912, and No. 3, 1885-6, No. 5454.
Veroffentlich des Kaiserlich Deutschen Gesundheit Amtes., Vol. 7, 1883, No. 4555.
Fifth and Sixth Annual Reports of Ill. State Board of Health, years 1882 and 1883, Nos. 4353 and 4687.
Twentieth and Twenty-fourth An. Reports of Registrar General of Scotland, Nos. 1507 and 3728.
Forty-third An. Report of Registrar General of England, No. 3730.
An. Report of Nat. Board of Health for 1884, No. 4929.
Review of Operations of the Nat. Board of Health, 1882, No. 3317.
An. Reports of Nat. Board of Health, year ending June 30, 1883, No. 3948, and for 1882, No. 3342.
Immigrant Inspection Service, Nat. Board of Health, No. 3390.
Immigrant Inspection Service Operations in Western District, No. 3290.
Epitome of Births, Marriages, Still Births, and Deaths in N. Y. City in the year 1879, No. 2019.
Births, Marriages, Still Births, and Deaths in N. Y. City in the year 1878, No. 2027.
Reported Mortality and Actual Mortality in N. Y. City for the year 1880, No. 2819.
Summary of Births, Marriages, Still Births and Deaths in N. Y. City, year 1880, No. 2818.
Reported Mortality, etc., in N. Y. City, year 1879, No. 2420.
The City Record, Vol. X., N. Y., April 11, 1882, No. 2692.
The City Record, Vol. XI., N. Y., Mar. 8, 1883, No. 2969, No. 3501.
Summary of Births, Marriages, Still Births, and Deaths in N. Y. City, year 1879, No. 2016.
Condensed Statement of Yearly Mortality in St. Louis, Mo., 1881, No. 2758.
Condensed Statement of Yearly Mortality in St. Louis, Mo., 1885.
Nineteenth An. Report of the Health Dept. of Cincinnati, year 1885, No. 5374.
Report of Board of Health of the City of Chicago, years 1874-5, No. 351.
Report of Depart. of Health, City of Chicago, year 1878, No. 1344.
Report of Board of Health—Chicago, year 1877, No. 1087.
Report of Board of Health—Chicago, years 1883-4, No. 5130.
Eleventh An. Report of Board of Health, City of Boston, years 1882-3, No. 3770.
Annual Report of Dept. of Health, City of Brooklyn, year 1884, No. 5069.
Annual Report of Health Dept., City of Baltimore, year 1883, No. 4003.

Report of Sanitary State of the City of Montreal, year 1883, No. 4644.
The Sanitary News, July 10, 1886.
Geburts und Sterblichkeits verbölt der Stadt Berlin, 1885.
Mortality sheet of City of Amsterdam, year 1883 and 1884. (In Dutch).
Resumé An. de Stat. Demographique et Medicale, Bruxelles, 1878.
Etude sur les Causes Nosologique des Décês, Bruxelles, 1864-66, No. 1866.
Annuaire de la Mortalité, etc., de Bruxelles, year 1877, No. 2167.
" " " " " " 1878, No. 2168.
" " " " " " 1879, No. 2169.
" " " " " " 1881, No. 2972.
" " " " " " 1882, No. 3829.
" " " " " " 1883, No. 4268.
" " " " " " 1884.
" " " " " " 1885, No. 5371.
Bericht des Med. Inspectorals über die Med. Stat. Hamburgischen St., year 1883, No. 4262.
Vierter Jahresbericht über den öffentlichen Gesundheits züstand und die verwaltung der öffentlichen Gesundheitspflege in Bremen in den Jahren, 1875 und 1876, No. 3643.
Fünfter Jahresbericht über den öffentlichen Gesundheits züstand und die verwaltung der öffentlichen Gesundheitspflege in Bremen in den Jahren, 1877 und 1878, No. 3644.
Report of Public Health in Bucharest, by Dr. Felix, year 1881, No. 3382.
Report on the State of Public Health in Dublin, year 1882, No. 3709.
The Decennial Census, Glasgow, 1881, No. 2741.

BY PROF. W. N. FERRIS.

Sanitary Record, Jan.—June, 1879, No. 3096.
" " July—Dec., 1876, No. 1558.
Popular Science Monthly, Vol. 12, 1878, No. 1591.
" " " Vol. 24, 1884, No. 4508.
The Medical Record, 1877, No. 1202.
" " " Vol. 21, 1882, No. 4470.
" " " Vol. 15, 1879, No. 3099.
" " " Vol. 20, 1881, No. 4469.
The Sanitarian, Vol. 5, 1877, No. 3174.
" " Vol. 6, 1878, No. 3175.
" " Vol. 3, No. 22.
" " Vol. 1, No. 16.
" " Vol. 4, No. 3173.
" " Vol. 2, No. 17.
Cincinnati Lancet and Clinic, Jan.—June, 1880, No. 3075.
" " " " June—Dec., 1880, No. 3076.
Prize Essays, American Pub. Health Association .1885, No. 5434.
Infectious Diseases in relation to Public School - L. W. Baker, No. 5433.
Circulars of information of Bureau of Education, No. 5, 1881, No. 2773.
" " " " " " " No. 6, 1881, No. 2930.
" " " " " " " No. 5, 1885, No. 5469.
Ventilation, By G. P. Conn, M. D., No. 3310.
Report of Committee on Sanitary Condition of Schools in the City of Philadelphia, No. 406.
Circular No. XXVII, State Board of Health of N. J., No. 4072.
" " XXVIII, " " " " " " " No. 4071.
Report of Special Committee on the Sanitary Condition of the School Houses of the City of Lynn, No. 4064.
San. Tract No. 1, San. Society of Brooklyn, No. 2830.
San. School Circular of N. J. State Board of Health, No. 3027.
Suburban School Houses, W. R. Briggs, No. 3311.
A Report on School Hygiene, D. F. Lincoln, No. 886.
The Health of Schools, American Soc. Science Association, No. 850.
Our School Houses, By Prof. T. W. Chittenden, No. 1965.
Health Lectures for the People, No. 3714.
School Life in its influence on Light and Figure, No. 2217.

Sanitary Condition and Necessities of School Houses and School life, No. 5437.
Light in the Public Schools, No. 2157.
Hygiene of our Schools, Albany Argus, June 28, 1885.

BY RUSSELL OSTRANDER.

Scientific American Sup., April 10, 1886.

BY HARRY S. BARTHOLOMEW.

Mental Physiology, Carpenter, No. 103.

BY JUDGE M. BROWN.

Sanitary Journal, Vol. 6, 1883, Library No. 4515.
" " " 5, 1882, No. 4514.
" " " 2, 1879, No. 4512.
Trans. N. H. Medical Society, at Concord in 1877, No. 928.
Reports and Papers, Amer. Pub. Health Association, Vol. III, 1875–1876, No. 994.
Powers and Duties of Local Boards of Health in Kansas, No. 5062.
Organization of Local Boards of Health in Pa., by Benj. Lee, Ph. D., No. 5322.
Tenement House Acts, City of New York, No. 1644.
An Act relating to the Board of Health, N. C., No. 4896.
Powers and Duties of Local Boards of Health, Wisconsin, No. 3799.
Laws relating to the Public Health, N. J., No. 5425.
Manual of Laws relating to the Pub. Health in N. Y., No. 2218.
Health Laws of the State of Iowa, 1883, No. 3911.
Public Health Laws of Illinois, No. 4359.
Trans. San. Inst of Great Britain, Vol. VI, No. 5462.
" " " " " " Vol. III, No. 4671.
Sanitary Legislation and Administration at Home and Abroad, No. 3708.
Sanitary Legislation in England and New York, No. 852.
The law of Pub. Health and Local Government, with the Acts of 1875, Chambers, No. 992.
Speech of Hon. J. H. McGowan—Prevention of Com. Diseases, No. 1337.
A National Quarantine, Speech by J. H. McGowan, No. 1517.
Trans. Nat. Assoc. for Promotion of Social Science, 1875, No. 1016.
Public Health, Vol. 7, 1877, No, 4825.
Sanitary Record, Jan.—June, 1877, No. 1559.

BY J. L. BURKHART, M. D.

The Practice of Sinking and Boring Wells, No. 686.
Water Analysis, Fox, No. 118.
Handbook of Hygiene, Wilson, No. 683.
Second An. Report of State Board of Health of N. Y., 1881–82, No. 3397.
Sanitary Engineering, Denton, No. 1008.
Parkes' Hygiene, No. 4128.
Dangers of Impure Ice, No. 3219.
Report on Chem. Examination of the waters of the Public Wells of Albany, N. Y., Tucker, No. 5159.
Potable Water, Eakin, No. 2142.
Water and Water-Supply, Corfield, No. 115.
Storage Reservoirs, Jacob, No. 1020.
Water Analysis, Wanklyn, No. 644.
Handbook for Water-drinkers, Austin, No. 3427.
Water Analysis, etc., Frankland, No. 2106.
Water-Supply, Nichols, No. 3683.

BY S. H. CLIZBE, M. D.

Trans. San. Institute of Great Britain at Exeter, 1880, No. 4670.
" " " " " " " Croydon, 1879, No. 4688.
" " " " " " Vol. IV, 1882-3, No. 4684.
Parkes' Practical Hygiene, Fourth Edition, No. 85.
Handbook of House Sanitation, Bailey Denton, No. 3923.
Drainage and Sewerage of Dwellings, Wm. Paul Gerhard, No. 4084.

How to drain a house, Waring, No. 5167.
Sewage-Disposal, Henry Robinson, C. E., No. 3925.
The Sewage Question, No. 166.
Purification of water-carried Sewage, No. 996.
The Sewage Question, Krepp, No. 180.
House-drainage and water service, James C. Bayles, No. 1139.
Popular Science Monthly, Vol. 10, 1877, No. 1589.
" " " Vol. 22, 1883, No. 3672.
Journal, Amer. Med. Assoc., Vol. 3, 1884, No. 5110.
The Sewerage and Drainage of Newport, R. I., No. 2445.
The Sewerage of Memphis, No. 2443.
The Disposal of the Slop-water of Villages, No. 124.
The Sewerage System of Detroit, W. F. Craig, C. E., No. 2160.
Storm-water in Town Sewerage, Geo. E. Waring, No. 2441.
The Separate System of Sewerage, Waring, No. 2907.
The Sewerage of Memphis, Waring, No. 2440.
Hering's Project for the Sewerage of Binghamton, N. Y., No. 3479.
Sewering and Draining of Cities, Waring, No. 2442.
Addenda to Report of Health Officer of Philadelphia, 1877, No. 1777.
Illustrations of the Durham System of House Drainage, No. 3425.
Methods of Sewerage for Cities and large Villages, Gardiner, No. 2807.
On the Disposal of Sewage, No. 3707.
Practical Points about Plumbing, Wingate, No. 2858.
Earth Closets and Earth Sewage, Waring, No. 652.
Sanitary Engineering, by Baldwin Latham, No. 149.

Distributions of the various documents on contagious diseases have been made during the year to the amount of many thousand copies, great numbers of these having been sent for distribution in localities where these diseases were present.

The following circulars on Communicable Diseases, and on the work of health officers, are now on hand:—

IN ENGLISH.

Circular No.	Name of Document.	Copies.
No. 54.	Prevention and Restriction of Small-pox (issue of 1882)	40
No. 110.	Restriction and Prevention of Scarlet Fever (issue of 1886)	9,900
No. 106.	Restriction and Prevention of Diphtheria (issue of 1886)	2,300
No. 75.	Prevention and Restriction of Cholera (issue of 1884)	29
No. 92.	Prevention and Restriction of Cholera (issue of 1885)	9,175
No. 91.	The Prevention of the Introduction of Communicable Diseases	966
No. 107.	Work of Health Officers (issue of 1886)	1,675
No. 93.	Permits for removal of Sick Persons or infected Articles	35
No. 105.	Circular to Physicians relative to Reporting cases of Communicable Diseases	250
No. 99.	Prevention of Typhoid Fever	2,750

IN FOREIGN LANGUAGES.

No. 45.	Restriction and Prevention of Diphtheria (German)	3,422
No. 45.	Restriction and Prevention of Diphtheria (Holland)	627
No. 46.	Restriction and Prevention of Scarlet Fever (German)	3,250
No. 46.	Restriction and Prevention of Scarlet Fever (Holland)	3,875
No. 54.	Prevention and Restriction of Small-pox (German)	4,474
No. 54.	Prevention and Restriction of Small-pox (Holland)	4,565
No. 68.	Leaflet on Contagious Diseases (French) (1,200 printed during the year)	1,050
No. 69.	Leaflet on Contagious Diseases (Danish-Norwegian)	195
No. 70.	Leaflet on Contagious Diseases (Swedish)	1,150
No. 73.	Leaflet on Contagious Diseases (Polish)	950

The following table shows the amount and kind of hard paper there was on hand at the time of making the last report, the amount purchased during the year, the amount used, and the amount now on hand:—

Kind of Paper.	On hand at Last Report.		Purchased Since Last Report.		Used During the Year.		On Hand Now.	
	Reams.	Sheets.	Reams.	Sheets.	Reams.	Sheets.	Reams.	Sheets.
Medium	1	325				5	1	300
Folio Post	16	108	13		20	89	9	19
Demy	9	165				283	8	362
Crown	7	123	10		16	470		133
Byron Weston		361						361
Cover paper	2	90	1		1	240	1	250
Manilla wrapping paper	2	288	2		1	418	2	350
Blotting paper		55				12		43
Book paper		216						216
Foolscap	1	360				228	1	132
Legal cap		370				130		240
Carbon paper		60						60
Postoffice paper	1	355				15	1	340
Flat paper			4			309	3	171
Bond paper		100						100

The hard paper has been used in making blank books for use in the office, circulars, announcements and programs for sanitary conventions, printed letters, writing paper, etc. The cover paper has been used for covers to reprints and record books for weekly reports of diseases, and wrappers for packages of ozone test-paper.

There are now on hand, 5,300 sheets of one-half letter and of foolscap made from book paper.

At the time of making the last report there were about 4,946 sheets of letter and half letter paper. Since that time 6 reams of folio post have been cut, mostly into sheets of half letter size. There are now on hand about 2,712 sheets of half letter paper, and 24 sheets of note paper.

There were about 164,166 envelopes on hand when the last report was made; 15,050 of the various kinds in use in the office have been purchased since, making a total of 179,216. There are on hand now of printed envelopes, 52,332; of blank envelopes, 89,087; making a total of 141,419. About 37,797 have been used in the work of the office.

There was on hand at the time of making the last report $107.47 in postage stamps, postal-cards and postal money. Vouchers for postage have been allowed during the year to the amount of $1,175.00. There is now on hand in postage stamps and unused postal-cards $36.45, and postal money $38.53, a total of $74.98. (This does not include postal-cards printed upon but not yet used.) The cost of postage during the fiscal year has been $1,207.49. Some of the principal items have been as follows:—

Distribution of Annual Reports	$371 94
General distribution of documents and circulars	256 49
Sending weekly meteorological, and monthly mortality statements and weekly bulletins	58 94
Collection and dissemination of statistics and information in regard to diseases	90 66
Sending announcements and programs for sanitary conventions	63 61
Sending meteorological material to observers	14 12
Regular and special correspondence of the office, and all other postage (including a considerable amount for distribution of documents on the restriction of diphtheria, scarlet fever, typhoid fever, and small-pox in localities where those diseases occurred)	351 73

Thus far this report has given exactly, or approximately, the kind and amount of property received, on hand, and disposed of by this office during the fiscal year ending Sept. 30, 1886. But in order to show exactly how much has been allowed by this board to be expended from the State treasury for all property and all other expenses during the time specified, the following classified statement of expenditures, as shown by all vouchers allowed by this board during the fiscal year, is here presented. It includes vouchers Nos. 1244 to 1368 inclusive, except 1248.

TOTAL AMOUNT AND CLASSIFICATION OF EXPENDITURES BY THE STATE BOARD OF HEALTH ALLOWED DURING THE FISCAL YEAR ENDING SEPT. 30, 1886, AS PER VOUCHERS NUMBER 1244 TO 1368 INCLUSIVE, EXCEPT NUMBER 1248.

Expenses of members	Attending meetings	$115 90
	Other official	360 25
Instruments and books		476 91
Paper, stationery, etc.		259
Postage	Office	1,175 00
	Members	......
Printing and binding		720 84
Secretary		2,500 01
Special investigations		50 00
Miscellaneous, includes express, etc.		133 11
Total		$5,791 84

Respectfully submitted,

HENRY B. BAKER, *Secretary.*

Having examined the Secretary's annual report of property received, issued, expended, and destroyed during the fiscal year ending September 30, 1886, and having compared the foregoing account of expenditures with the books in the Auditor General's office, I find the same to be correct.

A. HAZLEWOOD,
Committee on Finances of the Board.

Lansing, Mich., Oct. 1, 1886.

EXPENDITURES BY THE STATE BOARD OF HEALTH IN CALENDAR YEAR, 1886.

The appropriations for the board are made for the calendar year, and the expenses for the calendar year cannot exceed six thousand dollars ($6,000). The following is a statement of expenditures by the board during the calendar year, 1886:—

CLASSIFIED STATEMENT OF EXPENDITURES BY THE BOARD DURING THE CALENDAR YEAR, 1886.

Chemical analysis		$10 00
Engraving, Drawing, etc.		1 00
Expenses of members	Attending meetings	127 45
	Other official	617 98
Instruments and books		309 10
Paper, stationery, etc.		223 54
Postage	Office	1,425 00
	Members	1 00
Printing and binding		595 00
Secretary		2,500 00
Special investigations		50 00
Miscellaneous, includes express, etc.		138 26
Total		$5,998 83

EXPENDITURES IN FISCAL YEAR 1886, ON ACCOUNT OF THE BOARD.

The foregoing statements are of all expenditures made during the fiscal year 1886 from the annual appropriations of $6,000 placed at the disposal of the Board, for purposes specified in the acts making the appropriations. The clerk hire for the office in the State Capitol, and the expenses of printing and binding the annual reports, are provided for by other laws, and accounts for printing and binding the reports are audited by the State Board of Auditors, and not by the State Board of Health. The annual reports of the State Board of Health are published for the use of the Legislature, and for the Department of State, for distribution; only a portion of them are distributed by the State Board of Health. Although the Board is not required by law to keep an account of such expenditures through other departments of the Government, it has been thought advisable to make a statement, as complete as practicable, of all expenses growing out of the existence of the Board, even though this is not usually done by State Departments or Boards. Such a statement is as follows:

For clerks during fiscal year 1886	$8,642 04
For Printing " " "	1,258 33
For Binding " " "	759 44
For Photo-engraved plates in fiscal year 1886, for the annual report	165 47
For paper used in 1886 for report of 1885 (estimated*)	525 00
Expenses incident to the examination of plans for public buildings in fiscal year 1886	0 00

*By Hon. T. M. Wilson, Clerk to Board of State Auditors, to whom I am also indebted for the figures in the three preceding lines.

ABSTRACTS AND BRIEF ACCOUNTS OF THE PROCEEDINGS AT MEETINGS OF THE STATE BOARD OF HEALTH DURING THE YEAR ENDING SEPTEMBER 30, 1886.

REGULAR QUARTERLY MEETING AT LANSING OCTOBER 13, 1885.

Present: Hon. John Avery, M. D., President; Drs. Hazlewood, Kellogg, Lyster, and Baker.

The secretary presented his annual report of property, which was referred to the committee on finances.

The secretary read a resumé of the work of other boards of health.

Dr. Hazlewood read the report of the committee appointed to investigate the office of the secretary of the Board, and of the official actions of the secretary, which was adopted.

The question of sending agents into the lumbering camps to vaccinate, teach disinfection, etc., was considered; also the question of disinfecting by fumes of burning sulphur, its value, and the length of time fumigation should continue.

Afternoon Session.

A communication from H. P. Dearing, general baggage agent of the Michigan Central railroad, and president of the Michigan Association of General Baggage Agents, was read by the secretary. Mr. Dearing himself then appeared and explained the purpose of his association with reference to securing uniformity in rules for railroad transportation of dead bodies throughout all the States. He read a series of proposed rules, and stated that in some particulars they had been modified to conform to views expressed by the secretary of this Board, while in other particulars they were worded as they were because of action heretofore taken by the Iowa State Board of Health. His association hoped a set of rules could be made satisfactory to all the Boards and to the authorities of the various railroads, in which case it would probably tend greatly to the prevention of the spread of contagious diseases, and the prevention of nuisances from bodies of persons dead of non-contagious diseases.

It was moved and supported "that this Board approves of the rules of the Michigan Association of General Baggage Agents for the transportation of dead bodies," which was carried.

The subject of condensed rules for the guidance of State health inspectors of travel being under consideration, the secretary was instructed to inform inspectors that rules 19, 20, and 22 apply to freight and cars from infected districts consigned to points in Michigan, and that they are expected to disinfect all such cars and contents; also that this rule applies to all freight arriving by steamer or other vessel. It was also voted that after Oct. 15, 1885, no passenger car coming from Montreal or other infected district shall be allowed to enter the State without being properly disinfected. Also that inspectors are expected to notify health officers of places outside of Michigan to which are consigned freight cars from suspected places, if they are not disinfected because not consigned to this State. [The rules of State Board of

Health for State health inspection of travel are printed on pages 207–209 of the Report for 1885.]

A set of condensed rules for guidance of State health inspectors of travel was then adopted. [They are printed on pages 212–213 of the Report for 1885.] The secretary was directed to send copies of the condensed rules to railroad officials in Michigan and Canada, and to such other persons as he thought best.

It was voted that three additional inspectors be appointed by the Board,—one for Port Huron and two for Detroit.

It was voted that two alternate inspectors be appointed at Detroit to act whenever necessary because of the inability of the regular inspector to act; that the pay of such alternate inspectors shall be at the same rate as that to regular inspectors, and that their vouchers shall be regularly approved by this Board and the amount deducted from the pay of the inspector in whose place the service is performed.

It was voted that the pay of inspectors should be four dollars per day, that they should be paid monthly, and that the president and secretary are authorized to certify to the same, and approve the accounts for payment.

Drs. Baker and Lyster were made a committee to arrange and supervise the inspections of travel at Detroit and Port Huron; and if they should find at any time that a less number of inspectors could do the work, they were authorized to relieve those who could be best spared.

The secretary was directed to procure the addresses of lumber camps in Michigan, and send to such camps, or to the foremen or owners, documents on the restriction and prevention of small-pox, facts relative to vaccine virus, its price, etc., and suggestions as to not employing unvaccinated persons.

It was voted that, in view of the presence of small-pox in several cities in Canada, local health authorities be requested to encourage vaccination of citizens in their respective districts.

The secretary was authorized to issue a circular to local health authorities detailing methods by which vaccination can be accomplished.

Dr. Mortimer Wilson was appointed as an additional inspector at Port Huron.

The committee on health inspection was instructed to make the appointments provided for by the Board to be made at Detroit, after conferring with the president of this Board.

The secretary was instructed to correspond with Dr. H. W. Jones of Houghton, Mich., relative to holding a sanitary convention in that place.

The secretary reported that he had received from the secretary of the National board of health and had sent regularly each week to the health inspectors of travel in Michigan a copy of the bulletin showing the facts relative to cholera, small-pox, etc., in foreign ports and places.

The following resolutions were adopted:

Resolved, That inasmuch as the office work of the State Board of Health has grown by accretion during the years of its existence, and is now quite extensive, it is necessary that the same should be revised, with the intent to ascertain whether any modification in methods is necessary or advisable; therefore

Resolved, That the forenoon of the day of the next regular meeting be devoted to this question, and that in the meanwhile each member of the Board be considered a special committee, to report at that time.

REGULAR QUARTERLY MEETING AT LANSING, JANUARY 12, 1886.

Present: Hon. John Avery, M. D., President; Drs. Tyler and Baker. A quorum was not present.

The forenoon session was devoted to an informal discussion of the work of the office of the Board, and to listening to representatives of the Michigan Funeral Directors' Association, and others who had come to protest against the action of the Board in approving the rules prepared by the general baggage agents for the transportation of dead bodies. The rules require, among other things, the use of a rubber sack for bodies that are to be carried on trains. It was explained to the visitors that the Board had not "adopted," but only "approved" the rules, and that the railroads were not obliged by that action to be governed by them The undertakers admitted that the sacks would be useful in some cases; but they did not want to be confined to their use. They wanted the Board to recommend something else.

Afternoon Session.

Present: Drs. Avery, Tyler, Vaughan, and Baker.

Dr. Vaughan reported that his paper on Poisonous Cheese was ready to present to the Board. It was ordered printed in the Report for 1885. [It is printed on pages 221–226 of that Report.]

Prof. Vaughan reported verbally that he had found in milk left to decompose for some months a poison apparently the same as that which he had before found in poisonous cheese. The poison from the milk killed a small animal. He thought he should be able to suggest methods for the better prevention of cheese-poisoning through the avoidance of wooden receptacles and the retention of milk attached to angles or surfaces of receptacles, these being conducive to the particular fermentation to which he attributes the formation of the poison.

The board then listened to a delegation of undertakers, who asked the Board to express its view of the utility of hermetically-sealed receptacles of dead bodies to be transported by railroad, other than the rubber sack mentioned in the rules adopted by the railroad officers. The delegation presented a copy of rules published by the Railway Association of Michigan, wherein it was stated that the rules had been "adopted" by this Board. They also presented printed circulars of the Goodyear Rubber Company which they said had been sent to undertakers in Michigan, in which it was stated that the rubber sack "has been adopted by your State Board of Health." The undertakers said they had received the idea that this Board had adopted the rules and would enforce the use of the rubber sack to the exclusion of any other receptacle.

It was explained to the delegation that the rules were submitted to this Board by a committee from the Michigan Association of General Baggage Agents, and that their approval by this Board did not imply that they would be enforced by this Board; that there was no law making provision for such enforcement.

After discussion, the following was adopted:

WHEREAS, There has been misapprehension of the action taken by this Board relative to the transportation of dead bodies by railroads; therefore,

Resolved, That it is the opinion of this Board that dead bodies may be transported by railroad

without much danger of nuisance when encased in a rubber sack and otherwise, as published by the Railway Association of Michigan, or in any substantial hermetically-sealed casket or case enclosed as specified in the rules published by said association.

The committee on sanitary conventions was directed to make arrangements for holding a convention in Kalamazoo if the prospect seemed encouraging.

The following text-books were approved by the Board under the law: 1. A New School Physiology, with Appendix: Hygiene,—Narcotics,—Stimulants, by Richard J. Dunglison, A. M., M. D. 2. Elementary Physiology, with special reference to Hygiene, Alcohol, and Narcotics, by Richard J. Dunglison, A. M., M. D.

Dr. Sternberg's report on poisonous cheese was ordered printed in the Annual Report for 1885. [It is printed on pages 218–220 of that Report.]

The proposed document on Typhoid Fever was discussed and some amendments made.

REGULAR QUARTERLY MEETING, AT LANSING, APRIL, 13, 1886.

Present: Hon. John Avery, M. D., President; J. H. Kellogg, M. D., Arthur Hazlewood, M. D., C. V. Tyler, M. D., Henry B. Baker, M. D., Secretary.

The resolution offered by Dr. Hazlewood (see page xxxiii) and adopted by the Board Oct. 13, 1885, relative to an investigation of the work of the office, and which was postponed at the meeting in January, 1886,—Dr. Hazlewood not then being present,—was then taken up.

The members of the Board then entered into a prolonged and minute investigation and discussion of the great lines of work of the Board, with the view of determining if any part of it could profitably be done away. During this discussion, the secretary exhibited the various books which from time to time have been devised for the better performance of the different branches of work in the office. He commenced with the record of proceedings of the Board, nearly all of which is written by the secretary. In the "order book," orders for paper, stationery, printing, etc., are recorded, and bills received are compared with it before they are presented to the Board for allowance. Errors in bills against the Board have thus been detected. Every voucher ever allowed by the Board is carefully described in the "Expense Book." The property of the Board is recorded and traced in the "Property Book." The "Library Accession Book" and the "Library Loan Book" are described somewhat by their titles. Books and journals are loaned to physicians and others who write papers for the sanitary conventions. In order to make the library of most use to such as need to use it, a series of books are kept to serve the purposes of an *index rerum*, thus making it possible to pick up on short notice considerable material on such subjects as are noted in such manner. If more help was had, the library could be made still more useful by completing the card catalogue of the library, and keeping up that system with all accessions. The "sample book" contains one copy of each circular or other small article printed for the use of the office, for a member of the Board, or for general or special distribution. It is frequently useful to refer to. This year three new books are in use in which to record facts relating to the three communicable diseases, concerning which there is most correspondence in the office, namely, diphtheria, scarlet fever, and typhoid fever. They will make it possible to secure better reports, and to compile what is

learned by correspondence concerning those diseases very much better than has been done before.

Afternoon Session.

Present: Drs. Hazelwood, Kellogg, Tyler, Vaughan, and Baker.

The secretary read an abstract of his paper on the "Causation of Pneumonia." The paper had been prepared to be presented to the American Climatological Association at its coming meeting in Philadelphia. It included the evidence on the subject collected in the office of the State Board of Health by means of the weekly reports of sickness and the reports of meteorological conditions during the past eight years; and the writer of the paper claimed that the evidence is conclusive that the disease is controlled by meteorological conditions.

The paper on pneumonia was discussed by Drs. Vaughan and Hazlewood, chiefly, however, by way of questions as to how much scientific value attached to the reports received from the physicians who report to the office of the Board. In reply, Dr. Baker thought the reports of sickness under the observation of physicians were as reliable as any other written reports of facts observed; and when it was found, as in the paper he had read, that reports by another class of men, of observations of the temperature made by means of "instruments of precision," supplied data for curves which were identical with curves made from the data supplied by the physicians, there was not only evidence of some necessary relation between the two sets of facts, but also evidence of the truth of the reports by both sets of observers.

It was voted to print the required number of the pamphlet on the duties of health officers, etc., and that it include suggestions relative to duties in regard to glanders.

It was voted to print 6,000 copies of the document issued by this Board on the Restriction and Prevention of Diphtheria for distribution; and that it be amended so as to recommend the use of three pounds of sulphur instead of two pounds, to be burned for each one thousand cubic feet of air space in the room to be disinfected.

The secretary read a letter from Henry F. Lyster, M. D., member of the Board, concerning his attendance at the Sanitary Convention held at Woodstock, Ont., and concerning his lecture at Howell, Mich., before the sanitary association of that city. His letter also contained an invitation for this Board to hold a sanitary convention in Detroit.

The secretary presented an invitation from L. A. Warsabo, M. D., on behalf of the common council of Coldwater, for the Board to hold a sanitary convention in that city.

It was voted that the committee on sanitary conventions consider the invitations from Detroit and Coldwater, and act as circumstances and the best judgment of the committee shall dictate.

It was voted that the secretary's report of the State Health Inspection Service be printed in the annual report for 1885 [It is on pages 196–217 of that report.]

It was voted that the examination of plans for public buildings be printed in the annual report for 1885.

It was voted that the paper on "Communicable Diseases in Michigan in 1885" be printed in the annual report for 1885. [It is on pages 227–282 of that report.]

The article on "Good Health Results from Sanitary Work" was ordered to be sent to each member, and if approved, to be printed in the annual report for 1885. [It is on pages 191–195 of that report.]

A letter from H. H. Schaberg, M. D., of Kalamazoo was presented by the secretary. It proposed that this Board issue a circular to the physicians in the State relative to the reporting of communicable diseases. The manuscript for such a circular was presented to the Board, and it was ordered printed and distributed to as many physicians in Michigan as possible. [It is printed on pages xi–xii of this report.]

REGULAR QUARTERLY MEETING, JULY 13, 1886.

Present: Hon. John Avery, M. D., President; John H. Kellogg, M. D., Arthur Hazlewood, M. D., Henry F. Lyster, M. D., and Henry B. Baker, M. D., Secretary.

The president and secretary of the Board were made a special committee to visit and inspect, and to report to this Board the extent to which the recommendations of the Board relative to ventilation, water-supply, sewerage, etc., have been carried out at the following named institutions: The Northern Asylum for the Insane, at Traverse City; the hospital or infirmary for males at the Michigan Asylum for the Insane, at Kalamazoo; the hospital at the State Reform School, at Lansing; and the State House of Correction, at Ionia; also to report upon the sanitary condition of those State buildings, the plans for which have not been submitted to the Board.

Dr. Hazlewood read his report of attendance at the meeting of the American Medical Association in St. Louis, Mo.

Dr. Kellogg gave an account of the meeting of the Sanitary Council of the Mississippi Valley, which he said did not hold a regular meeting except for the election of officers, and that was in interval of meetings of the section on State medicine in the American Medical Association.

The thanks of the Board were tendered to Drs. Hazlewood and Kellogg, and the report by Dr. Hazlewood was directed to be printed in the Annual Report. [It is printed on pages 165–166 of this Report.]

Dr. Lyster then read a paper and made remarks relative to an analysis of 500 deaths of persons aged 18 to 60 years, occurring in the 18 years' experience of the Michigan Mutual Life Insurance company, showing the average age of those who died from each disease, and other facts of interest. It was accepted with thanks, and ordered to be printed. [It is on pages 189–195 of this Report.]

Afternoon Session.

The following named members were present: John Avery, M. D., president; Drs. Hazlewood, Lyster, Kellogg, Vaughan, and Baker.

Dr. Lyster spoke on the subject of the discontinuance of the statistics of meteorology and sickness,—a subject proposed and discussed by other members of the Board at a preceding meeting. He said that this work had been taken up on his motion, many years ago, and he was still strongly in favor of its continuance. He thought there were many erroneous opinions relative to the climate of Michigan, which this line of work was calculated to dispel. As chairman of the committee on epidemic, endemic, and contagious diseases, he was also in favor of continuing the system of reports, and the sta-

tistics based upon the reports of sickness. He thought the longer they are continued the more valuable they become.

Dr. Kellogg spoke of the thoroughness with which work in the direction of sanitary inspections and sanitary surveys was being done in Illinois. He spoke especially of the work at Galesburg, where all privies are built above ground, all vaults cleaned out, and an astonishing amount of good work reported, largely influenced by the sanitary survey. This had been gleaned from the printed proceedings of a recent meeting of the Illinois State Board of Health. He spoke of the committees appointed by the Michigan State Board of Health in years past, and of their reports on the subject of sanitary surveys, and advocated immediate action by this Board toward securing such surveys and inspections throughout Michigan as generally as possible.

Dr. Vaughan said that a sanitary survey of Ann Arbor had been done pretty thoroughly by policemen detailed for that purpose, acting under the direction of the health officer.

After much discussion the secretary was instructed to prepare a blank for house-to-house inspection in small places, and another for cities having sewers, plumbing, etc., and to send the blanks to the members of the Board for suggestions. He was also directed, when the blanks were perfected and approved, to send them to the health officers with urgent requests that a house-to-house inspection be made, and with instructions as to the method of making the inspection.

Dr. Vaughan read his report on the Lawton ice-cream poisoning. It was received with special thanks, and was ordered to be printed in the Annual Report. [It is on pages 154–160 of this Report.]

Dr. Vaughan spoke of the receipt of several samples of beef, supposed to be poisonous, but they were too small to learn much from them.

It was decided to issue 10,000 copies of the document on Restriction and Prevention of Scarlet Fever, and 5,000 of the one on Prevention and Restriction of Small-pox, with necessary changes.

A letter from C. S. Lombard, M. D., health officer of Negaunee, Mich., describing the source of the public water-supply of Negaunee, the location of slaughter-houses, which are alleged nuisances, stating difficulties in their abatement, and asking that a committee of this Board visit Negaunee and advise with him on the several subjects, was presented by the secretary. The president and secretary were directed to visit Negaunee as soon as practicable in accordance with the invitation.

The secretary read a letter from the secretary of the State Board of Corrections and Charities, requesting the Board to give an opinion, in response to a resolution of the Board of Charities, as follows:—

"*Resolved*. That the Board of Health be requested to furnish to this office an opinion on the best mode of providing for privy accommodations, and disposing of excreta for jails and poor houses."

The subject was referred to the committee on excreta, with request to report at the next meeting of this Board.

The secretary read a petition signed by citizens of Big Rapids, asking that this Board hold a sanitary convention in Big Rapids. The Board requested the president and secretary to stop at Big Rapids, on their way to Negaunee, to make arrangements for holding a convention.

Dr. Kellogg gave a report, mostly verbal, of an examination which he had made of the sanitary condition of the court-house and jail at Stanton, Mich. He was requested to write his report for publication in this Report. [It is printed on pages 171–175 of this Report.]

The secretary presented a letter from A. S. Martin, M. D., of Texas, Mich., relative to premature burials.

SPECIAL MEETING, SEPT. 10, 1886.

This meeting was held at the time of the Sanitary Convention at Coldwater, and no business but the auditing of bills was transacted. Members present: Drs. Kellogg, Vaughan, Hazlewood, and Baker.

ABSTRACTS OF QUARTERLY REPORTS PRESENTED BY THE SECRETARY AT REGULAR MEETINGS OF THE BOARD, OF WORK DONE IN THE OFFICE OF THE STATE BOARD OF HEALTH.

QUARTER ENDING OCT. 13, 1885.

An abstract of the proceedings of the July meeting of this Board was sent to sanitary and medical journals which exchange with this office.

During the past quarter the correspondence of the office, exclusive of postal-cards, hektograph letters, etc., covers over 900 pages of the letter book, of which 182 were modified circular letters to local health officers in regard to communicable diseases. One hundred and twenty-nine books and pamphlets have been received and placed in the library of the Board during the quarter, most of them in exchange for the publications of this Board.

During the quarter, pamphlets have been printed by order of the Board as follows: "The Prevention of the Introduction of Communicable Diseases," 10,000 copies; "Permits for the Removal of Sick Persons or Infected Articles," 2,000 copies; "Prevention and Restriction of Cholera," 20,000 copies; "Names and Addresses of Health Officers in Michigan for the Year 1885–86," 1,600 copies; and "Rules" for the Health Inspection of Immigrants and Travelers, 500 copies. A blank has also been prepared and printed, designed for the use of State Health Inepectors of Travel in making their reports to this office.

The regular weekly and monthly bulletins of "Health in Michigan" have been issued. Supplementary bulletins "Good Health Results from Sanitary Work," showing apparent marked decrease in sickness in Michigan during the months of July and August have been issued. About 500 of each of these supplementary bulletins were sent to editors in Michigan and others.

Besides the general distribution of a large number of documents to local health officers, clerks of townships and villages, and sanitarians, there have been sent out about 8,000 copies of documents relating to the restriction and prevention of communicable diseases, to localities where such diseases were known or believed to be present, for distribution to the neighbors of the persons sick.

About Oct. 1, 1885, information reached this office that a man by the name of H. N. Babcock had, without permission from any health authority, removed the body of Dr. Bettes (who died of small-pox about one year ago) from near Le Roy, Osceola county, Mich., to Byron Center, Kent county, Mich. The informant was mistaken in regard to the destination, which proved to be Sparta Center, instead of Byron Center. The secretary immedi-

ately notified the health officer of Byron Center, also H. N. Cargill, secretary of the Grand Rapids board of health, and the daily papers in Grand Rapids. After learning that the body had been buried at Sparta Center, the secretary wrote a similar letter to the health officer of that place. He recommended that Babcock and all connected with disinterring and carrying and burying of the body be promptly vaccinated and isolated or placed under surveillance until the danger of their spreading the disease had passed—16 to 20 days. It was also recommended that citizens generally, along the probable route of Babcock, be vaccinated. Babcock had no permit for the removal of the body, and probably used very little, if any, precautions. The body was taken in a wagon.

Sept. 16 there was held in Lansing a meeting of the Michigan Association of General Baggage Agents, for the purpose of discussing the subject of "Transportation of Dead Bodies." The National Association of Baggage Agents was represented at this meeting by its President, Mr. J. D. Marston of Chicago, who is also chairman of the committee appointed by the national association to investigate the above subject. By invitation the secretary attended the meeting in Lansing, and took part in the discussion. A committee was appointed of which Mr. H. P. Dearing, the general baggage agent of the Michigan Central railroad, is chairman; and that committee will probably present a communication to this Board at this meeting.

There is complaint of bad odors arising from corpses transported through the State. It is claimed that the fluids not infrequently run out of the boxes and across the baggage car. Corpses are usually carried with baggage under them or piled upon them. It would seem to be desirable that there should be greater uniformity and care in packing bodies for transportation, even in cases where no contagious disease is suspected, because undoubted nuisances do arise under the present circumstances.

In response to a request from Dr. Bion Whelan of Hillsdale, and in reply to letters from the mayor of Hillsdale, some time and thought were devoted to the subject of a proper water-supply for the city of Hillsdale. Analysis of samples of water and numerous statements of facts relative to the conditions about Hillsdale were studied, and advice was given in several letters addressed to Hon. Chauncey F. Cook, mayor of the city.

QUARTER ENDING JAN. 12, 1886.

An abstract of the proceedings of the October meeting of this Board was sent to sanitary and medical journals which exchange publications with this office.

Ninety-two books and pamphlets have been received and placed in the library of the Board during the quarter, most of them in exchange for the publications of this Board.

During the quarter, 1,390 pages of hektograph work and 2,490 pages of papyrographing have been done in this office. The correspondence of this office, exclusive of postal-cards, hektograph letters, etc., covers 761 pages of the letter book, including 182 circular letters to local health officers in regard to communicable diseases.

The Annual Report of the Board for 1884 is printed and in the hands of the binder. It will soon be ready for distribution. As a committee of this Board, the secretary went to Howell, and arrangements have been made for a sanitary convention to be held there March 3 and 4, 1886.

A document has been prepared on the "Prevention of Typhoid Fever." It has been sent to Dr. H. F. Lyster (who with the secretary constituted the committee appointed for this purpose), for his corrections and suggestions, and has been received again at this office. Circulars, documents, and blanks have been printed as follows: Leaflet on the Prevention of Contagious Diseases in French from plates, 1,800 copies; Condensed Rules for the guidance of State Health Inspectors of Travel; copies of the announcement of a Sanitary Convention to be held at Howell, Mich., March 3 and 4, 1886, and a circular to correspondents relative to diseases in Michigan in 1885. There have also been printed copies of the blank for the annual report of health officers and copies of the circular letter transmitting this blank, also copies of the blank for the annual report of the clerks of the local board of health and copies of the circular letter transmitting this blank. These circulars and blanks, together with blanks for copy of record of cases of diseases dangerous to the public health and printed envelopes for return, have been sent to 1,416 health officers and 1,416 clerks of cities, villages and townships. The annual reports are now being returned to this office at the rate of about 60 per day.

The announcements of the sanitary convention to be held at Howell have been sent to health officers, editors, correspondents, and sanitarians in this State, and for distribution in Howell and vicinity.

The weekly and monthly bulletins of "Health in Michigan" have been issued regularly, and the usual number of documents relating to the restriction and prevention of communicable diseases have been sent to localities where such disease were known or believed to be present, for distribution to neighbors of families in which such diseases are reported.

The tables and exhibits of the article on "Causes of Diseases in Michigan" in 1884 have been finished. Comments on these exhibits and tables are nearly completed for the report for 1885.

Inquiry was received at this office relative to a privy over a furnace for the combustion of excreta. Hearing that Hon. Daniel L. Crossman of Williamston had constructed such a privy, the secretary visited Williamston and made a thorough examination of the structure. One point which he wished to investigate was whether or not a nuisance was created when the fire was first lighted, because, although this privy was called a "Crematory Privy," the excreta are gradually warmed up after the fire is lighted, and not as in a crematory where the organic matter is suddenly exposed to the highest temperature. He had expected to have the fire lighted after he arrived there so he could investigate that point; but as a matter of fact, the fire had been lighted some time before his arrival so he was unable to do so. On nearing the premises the secretary found the wind blowing from the privy towards him, and when about ten or fifteen rods from it he noticed an odor, but it was not offensive. This came down to the earth because the chimney was not very tall,—only about fifteen feet. It seems that with a high chimney and provision being made for the gases to leave the furnace and enter the chimney at a high temperature, excreta may be thus effectually destroyed.

The Victor Kerosene Tester with directions for use has been received at this office from the inventor, Dr. John T. Stoddard, Northhampton, Mass. An advantage is claimed for this tester over others, that it obtains the lowest possible flashing point, and that its results are uniform when used by experts or inexperienced persons. The tester consists of a copper water bath, enclos-

ing a glass cylinder filled with oil. This cylinder is connected by a glass tube (joining at the bottom) with a rubber tube, which by means of a bulb bellows forces a continuous current of air through the oil. The current is continued until the vapor ignites with a flash which runs down to the surface of the oil. The thermometer is suspended in the oil by means of a bent wire.

A. McEachearn, health officer of Newton Tp., Mackinaw Co., reports one fatal case of glanders in man, in his jurisdiction. The patient was taken sick in October and died Dec. 16, 1885. Dr. Wm. Parmenter, a correspondent of this Board from Vermontville, Eaton Co., also reports a case of glanders,—taken sick March 1, and died June 25.

A letter dated Dec. 19, 1885, was received at this office from H. N. Cargill, clerk of the board of health of Grand Rapids, of which letter the following is a part:—

"I see by the daily paper that hog cholera prevails quite extensively in Eaton county and adjoining county, viz.: Barry. As this is the time when pork is marketed, we are afraid of getting some of this pork. I believe if a hog were killed upon the first appearance of the symptoms, being careful to bleed them carefully and dress them neatly, that no inspector could tell it in the ordinary manner of inspecting. I understand that over 2,000 hogs have died in Eaton Co., and that the disease shows no abatement. I should suppose that the State Veterinarian would be well informed in regard to it."

This information was at once conveyed to Hon. H. H. Hinds, President State Live Stock Sanitary Commission, together with a list of health officers in Michigan with whom he might get into communication. The secretary also stated that he would be glad to coöperate with the commission as much as possible in the work of restricting such a disease.

A reply dated Dec. 23, 1885, was received from Hon. H. H. Hinds, stating that hog cholera had been quite prevalent throughout the State and that the Live Stock Sanitary Commission "are at a loss to know what to do to stamp this animal disease out," because veterinary scientists had as yet "certainly laid down no rules for either its cure or control." The letter stated that the Live Stock Sanitary Commission would be "very glad of the valuable and powerful aid of the State Board of Health in protecting the health of the domestic animals of the State so that our people may not be permitted to eat diseased and unwholesome meat."

QUARTER ENDING APRIL 13, 1886.

The proceedings of the last meeting of the Board have been printed in pamphlet form; and 1,200 copies were distributed—to members of the legislature, all the newspapers of Michigan, the health officers of cities and villages, sanitary journals and exchanges, etc.

Arrangements were made for holding a Sanitary Convention at Howell. 1,800 announcements and about 1,800 programs were printed, and many of them mailed.

The printing of the Proceedings of the Ypsilanti Sanitary Convention has been completed, and several hundred copies have been distributed.

For several years data have been accumulating relative to the causation of several diseases, and especial effort has been made to collect information as to the cause of pneumonia, that being one of the diseases that causes many deaths in Michigan. During the past quarter, all the moments that could be spared from the regular and extra official work have been devoted to the prepa-

ration of a paper embodying the data collected bearing upon the causation of pneumonia. Special effort was made to do this because of an invitation received by your secretary to read a paper before the American Climatological Association which meets in Philadelphia May 10 and 11, 1886. This seemed an excellent opportunity to place the results obtained in Michigan before a body of scientific men especially capable of discussing it and of pointing out any deficiencies which should be supplied, or any defect in the reasoning as to the causation of pneumonia,—the object being to so perfect the information as that it may be put before the people in a condensed form with a view to the avoidance and prevention of some of the causes of this disease, through a better knowledge of their nature and mode of action. The evidence now collected seems to show that we have a knowledge of the causation of pneumonia.

About 2,400 copies of the report of the Board for 1884 have been distributed direct by mail to health officers of townships, cities, and villages, to clerks and presidents of boards of health of cities and villages, to correspondents of the Board, and others; 10,000 copies of a document [No. 99] on Prevention of Typhoid Fever have been printed, and a large number distributed to health officers of cities, townships, and villages, to members of the legislature, and to all newspapers in Michigan.

About 10,000 copies of documents on the restriction of the different communicable diseases have been distributed in Michigan to points where communicable diseases were reported to have occurred.

Annual reports of clerks and health officers have been received and filed. Considerable work has been done on these reports in preparing for their compilation, and all facts they contain in regard to the sanitary condition of localities in Michigan have been gleaned and are ready for tabulation.

Blanks have been sent to clerks and presidents of cities and villages, and to supervisors of townships, with a demand for the return of the names and addresses of health officers for the year 1886.

A large amount of work has been done in preparing articles for the annual report of the Board for 1885. The article on "Principal Meteorological Conditions in Michigan in 1884," and one on "Causes of Diseases," based on weekly reports of sickness during the year 1884, are nearly ready for the printer. An article on "State Health Inspection of Travel, under the direction of the State Board of Health and of the United States; and other efforts to Protect Michigan from Small-pox," has been prepared for the Report for 1884.

On March 19 the secretary went to Pinconning, Mich., for the purpose of investigating a supposed case of Asiatic cholera, and on his return made a report, of which the following is a copy:

THE CASE OF SUSPECTED CHOLERA IN PINCONNING, MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH,
Office of the Secretary, Lansing, Mich., March 25, 1886.

March 19, 1886, I received the following from W. B. Abbott, M. D., health officer of Pinconning, Mich.:—"On eve. of 16th inst. was called to attend Mr. A. F. Smith, aged 43, who was taken at about 7 P. M. with vomiting and diarrhea, soon followed by cramps. When called, I found him in this con-

dition, which was rapidly growing worse. I soon controlled the former symptoms, but the cramps continuing, Dr. C. T. Newkirk of Bay City was called in council.

"The matter vomited and dejected was a clear serous liquid, slightly acid, and in very large amount. Soon symptoms of collapse came on, the extremities became cold and the pulse decreased and finally ceased at the wrist, the sight left the eyes and roaring sound filled the ears, the voice became hoarse, the face assumed a most anxious expression, the eyes became lusterless and fixed, the cramps were most distressing. By 11 P. M. the symptoms began to abate. At 11:30 Dr. Newkirk arrived, who pronounced it a case of cholera, and as this doctor had attended a very large number of cases in South America during the great epidemic there, I thought it but right to respect his opinion so far as to write this description. There was not the bilious matter in the emesis, but 'rice water' vomit instead. The patient is improving but is still followed by *suppression* of urine."

March 19 I went to Pinconning to investigate. Since my return I have received a letter from Dr. C. T. Newkirk of Bay City, Mich., who was called by Dr. Abbott to see the case, in which he says: "The skin was cold and covered with a dampness which I believe is peculiar to cholera; lips and skin were blue; the voice was hoarse; stools were of the nature of rice water; no blood or bile was ejected; legs, arms, and stomach cramped terribly; pulse very low; eyes sunken; labored breathing; great thirst. The nose and tongue were cold; there was suppression of the urine; the face was pinched; temperature 97°. After about two hours, the body began to get warm, and in eight hours pulse came up to 120; temperature, 103."

Dr. Newkirk also says: "I have had a large experience with cholera, and have no hesitation in pronouncing this a case of Asiatic cholera."

Dr. Newkirk is a graduate of Victoria College, Toronto, and is an old practitioner.

I reached Pinconning at 11:20 P. M. March 19, and immediately made an investigation of the case. The patient was yet in bed. Mr. Smith is a prominent lumberman, 43 years old. He still looked haggard, and appeared somewhat restless; his tongue was not coated, his pulse was full and strong and not much faster than normal.

By questioning the patient and others I verified, so far as non-professional observers could verify, the observations of the physicians. From the patient I also elicited the fact that during his attack he did not suffer from colic, nor from much pain in his bowels, and that the passages were painless. His first loose discharge was while he was in camp—eight miles distant—but as he did not use a privy, it seemed impracticable to secure any disinfection of that substance. He and his wife are unusually intelligent persons, and Mrs. Smith suspected from the first that it was cholera. All discharges were received into vessels containing copperas. When these cases are not followed by other cases, they are not usually believed to be genuine Asiatic cholera, but owing to this intelligent precaution of the family, and to thorough measures of disinfection afterwards ordered, and which have probably been used, this test will not apply.

Besides giving directions as to disinfection which I was assured would be faithfully attended to, I made inquiry as to the possibility of Mr. Smith's having accidentally taken some irritant poison, such as tartar emetic, or corrosive sublimate, but no probability of that kind could be made out. I also

made vigorous effort to learn any possible way in which cholera might have been brought into Pinconning. Immigrants had recently arrived in the vicinity, but none were from a place known to be infected. The men in the camp where the patient had been had not been outside the State, nor had Mr. Smith been out of the vicinity. As to fruits from the Mediterranean, oranges had been in the house, but the patient is not fond of oranges. He is fond of raisins, however, and has been in the habit of eating them uncooked. A box, partially emptied, in the house apparently came from Valencia, Spain, and the raisins were not coated with sugar, but were apparently fresh, probably of the crop of 1885, at which time cholera is known to have prevailed extensively in Valencia. Whether there is any connection between the box of raisins and the case of sickness is yet problematical.

The water-supply in Pinconning is from wells, which are now (March 20) full nearly to the surface of the ground. There is not much purification of the water by filtering through the few feet of sand and sawdust which covers the clay. One well in front of a public house is about thirty-five feet from that part of the railroad track which is under the closet of the passing cars, so that if there should chance to be any dropping from the closet of a passing car, it might with the spring rain be washed almost immediately into the well and be quite freely distributed to those who drink from that well. There is no evidence connecting it with this case of sickness, but that is not a very safe well to drink from, and might be liable to be infected if any infectious disease should pass through on that railroad. The character of the soil and its relations to the soil-water used for drinking purposes in Pinconning render it very important that there should be thorough disinfection of all infectious discharges thrown into privies or upon the surface of the earth. The officers and members of the local board of health told me they were in the habit of thoroughly disinfecting privies every spring. I urged upon them the importance of doing this with special thoroughness this spring, and also the importance of prompt disinfection of the privy and surroundings at the residence of the patient whom I went to visit.

HENRY B. BAKER.

QUARTER ENDING JULY 13, 1886.

About 6,000 copies of circulars on the prevention and restriction of the dangerous communicable diseases have been sent to localities in Michigan where communicable diseases were reported to be present.

Returns of names and addresses of health officers in Michigan for 1886–7 have been received and filed, and a list of such health officers has been made ready for printing.

The secretary made a visit to Coldwater on June 17 for the purpose of meeting a citizens' committee on sanitary convention. The convention was fixed for Sept. 23 and 24, but has since been changed to Sept. 9 and 10. Announcements of the proposed Coldwater convention have been printed and distributed. Much work has been done in the way of supplying authors of papers to be read before such conventions with literature from the library of the Board bearing on their subjects.

The meteorological tables for the year 1885, to be printed in the report for 1886, are nearly completed.

A copy of the record of the meteorological observations taken at this office has been sent each month to the chief signal officer at Washington, D. C., as

well as reports of all thunder storms. A careful report of the tornado near Lansing, May 14, was sent to the chief signal officer.

A sample of pressed beef that had caused sickness at Ionia was received from Dr. S. V. Romig and forwarded to Dr. Vaughan, as well as a sample from Whitehall. A quantity of the ice cream that made 19 persons sick in Lawton, Van Buren Co., was received from the health officer of that village and forwarded to Dr. Vaughan, as well as a bottle of the vanilla extract, and a small quantity of the extract actually used in that instance.

During the past three months, the correspondence of the office, excluding postal-cards, covers about seven hundred pages of the letter-book. The correspondence was largely in regard to outbreaks of communicable diseases, replies to inquiries in regard to powers and duties of health officers and local boards of health, and interpretations of other public health laws.

The compilation of the card reports for 1885 is nearly completed, ready for making up the tables and exhibits for the article on "Weekly Reports of Diseases," for the report for 1886.]

ITEMS OF THE WORK OF OTHER BOARDS OF HEALTH.

QUARTER ENDING OCT. 13, 1885.

From the Annual Announcement of *Med. Dep't of State University of Iowa, p. 7:*

"The Board of Regents have added a lectureship on Sanitary Science and Public Hygiene, which will be filled by Prof. W. S. Robertson, President, Iowa State Board of Health," a very talented gentleman.

The Sec. of the Maine State Board of Health has recently been chosen to lecture on Hygiene or Sanitary Science at some college in Maine.

MISSOURI STATE BOARD OF HEALTH.

The Missouri State Board of Health was lately reorganized by the choice of Mr. William Gentry as president, Dr. George Homan as secretary, and Mr. J. B. Prather as treasurer.

VIRGINIA STATE BOARD OF HEALTH.

The legislature of Virginia has never made any appropriation for the use of its State Board of Health. At the late meeting of the Virginia State Medical Society resolutions were passed authorizing and requesting the president of the State Board of Health to appoint a health officer in every county, whose duties shall be to coöperate with the State Board, and to secure the aid and coöperation of all licensed physicians in making a record of the prevailing diseases (endemic and epidemic) in his county; the number of cases, number of deaths, together with such other facts in the history as may be of general interest, and to report the same to the State Board of Health; that these reports be tabulated by or under the direction of the State Bd. of Health, and presented in Annual Report to the State Medical Society. Thus the medical profession in Virginia are undertaking the systematic record of prevailing sickness, with the view of studying it in a scientific manner, at their own expense.

QUARTER ENDING JAN. 12, 1886.

PENNSYLVANIA STATE BOARD OF HEALTH.

We have received a circular letter dated Oct. 15, 1885, officially informing this Board of the organization of the Pennsylvania State Board of Health, with Dr. E. W. Germer of Erie as president and Dr. Benj. Lee of Philadelphia as secretary, and expressing a desire to "cultivate the most friendly and intimate relations" with this body.

One feature of the law governing that board is worthy of mention,—that which confers upon the board "in cities, boroughs, districts, and places having no local board of health, or in case the sanitary laws or regulations, in places where boards of health or health officers exist, should be inoperative," "power and authority to order nuisances or the cause of any special disease or mortality to be abated and removed." The Pennsylvania Board in pursuance of this authority, has issued a circular of "Provisional Regulations for preventing slaughter-houses, stock yards, hog-pens, bone-boiling, and fat-rendering and other similar establishments from being or becoming prejudicial to the public health."

MINNESOTA STATE BOARD OF HEALTH.

A Conference of the Minnesota State Board of Health and about twenty representatives of local boards of health of the State was held Oct. 20 and 21, 1885, in connection with a popular Sanitary Council for Southeastern Minnesota.

Reports in regard to glanders showed that the disease was being driven out of Minnesota. There were 249 cases reported from March 7 to Nov. 1, 1885; of which 121 were killed, 104 isolated, and 61 released. There has been one fatal case of glanders in Minnesota in a human being.

MAINE STATE BOARD OF HEALTH.

The State Board of Health of Maine, at its quarterly meeting held Dec. 28, 1885, voted to instruct its secretary to recommend that the inspection service along the provincial border be continued, as there were so many towns down the St. Lawrence and outside of Quebec where small-pox was still raging. It was voted to make a beginning in the equipment of a microscopical and chemical laboratory where specimens of water might be tested or other chemical processes attended to.

The secretary has issued a circular giving a list of 87 places in the Province of Quebec affected with small-pox brought from Montreal.

KANSAS STATE BOARD OF HEALTH.

The secretary of the Kansas State Board of Health has in course of preparation the first annual report of that Board which he expects to be issued from the press by Feb. 1, 1886.

ROCK ISLAND, ILL., CITY ABATTOIR.

The Rock Island Daily Union of Nov. 5, 1885, contains quite an extensive

account of a new public abattoir *built and owned by the city* of Rock Island, Ill. The first trial was made Wednesday afternoon, Nov. 4, in the presence of the health commissioner and several others.

ONTARIO BOARD OF HEALTH.

The Provincial Board of Health of Ontario, not being satisfied that everything was being done which should be done by the local Board of Health of Toronto, requested a conference at that place. In the course of the proceedings the President of the local board became angry and adjourned the meeting.

IN MASSACHUSETTS.

Governor Robinson of Massachusetts in his message, printed in the Boston Evening Record of Jan. 7, 1886, recommends the establishing of an independent State Board of Health, allowing the present Board to continue to have supervision over the charities and lunacy.

MANITOBA.

At the request of a prominent physician of Manitoba, I sent him copies of the rules governing the State Health Inspection of Travel in Michigan which he wished as a basis of rules to be adopted there. I have since received from the Deputy Minister of Agriculture, Statistics and Health, a copy of the Manitoba Public Health Service and the regulations and rules made by His Honor, the Lieutenant-Governor-in-Council, for the inspection of persons arriving in Manitoba. These regulations show use to have been made of our rules.

CALIFORNIA STATE BOARD OF HEALTH.

The usual monthly bulletin of the California State Board of Health for November states that diphtheria is making a steady advance throughout the State.

CONNECTICUT STATE BOARD OF HEALTH.

The report of Dr. C. A. Lindsley, Secretary Connecticut State board of health, for October, 1885, notes especially the increasing mention of typhoid fever in many places. The statement for November indicates, he says: "A general state of health throughout the whole commonwealth which has not been known before within the experience of the State Board of Health. It is a just and reasonable inference that the attention which has been generally given to sanitary improvements in apprehension of cholera has been the principal agent in producing the happy result."

HEALTH INSPECTION OF TRAVEL.

The secretary of the Ontario board of health requested the Marine Hospital Service to discontinue the inspection on the borders between this country and Canada, on the ground that the inspection instituted by the Canadian

authorities was sufficient to protect the United States. A copy of the letter was sent by the Surgeon General of the Marine Hospital Service, to this office and one to Dr. Rauch of the Illinois board of health, who replied to Dr. Hamilton that our inspections were unnecessary. I replied to Dr. Hamilton that the letter of the secretary of the Ontario board of health was evidently written in the interest of the railroads and not in the interest of public safety. A copy of Dr. Rauch's letter was sent to this office, and I replied that in my opinion the Canadian inspection was not a sufficient safeguard, and did not warrant the discontinuance of our own inspection. Notwithstanding my views and the protest of Dr. Wight, health officer of Detroit, and the view expressed by the health officer of the port of New York that there should constantly be a thorough inspection service at Port Huron, the Marine Hospital Service discontinued the service at all the places.

QUARTER ENDING APRIL 13, 1886.

OHIO STATE BOARD OF HEALTH.

April 8, a bill to create a State board of health in Ohio became a law. A letter from R. Harvey Reed, M. D., of Mansfield, Ohio, who has been one of the most active supporters of the bill, says that the governor of Ohio will make appointments, according to the law, very soon.

SMALL-POX NEAR MONTREAL.

It is said that eight cases of small-pox have been discovered at Longuenie, near Montreal, but no steps are being taken by the authorities to prevent the spread of the disease.

LOUISIANA STATE BOARD OF HEALTH VS. NATIONAL BOARD OF HEALTH.

The president of the Louisiana board of health has been making vigorous efforts to have a commission appointed by U. S. Congress to visit South America and study the alleged successful vaccination of yellow fever by Dr. Friere. He has publicly in the New Orleans papers attacked the National board of health, claiming that members of it were interfering with his scheme and thus working against the public health interests of his State. Prof. Chaillé, member of the National board of health, resident of New Orleans, has replied to Dr. Holt, pointing out the fact that the National board of health was created largely because of the danger from yellow fever, and charged with the duty of making just such investigations as is proposed by the new commission, and that his official oath makes it his duty to look after such measures, and suggests that if there has been any interference of rights it has not been by members of the National board of health with the Louisiana Board, however the reverse may have been true. He deprecates any such public dissensions among sanitarians and advocates the more complete investigation into the subject of yellow fever innoculation than that attempted by Dr. Friere, and recommended by Dr. Holt. He advocates quarantine as does Dr. Holt, and does not recommend total non-intercourse with infected ports as Dr. Holt had charged that he did, and stands ready to favor any more efficient public health service than the National board of health, whenever any such can be devised and made the law of the land.

PENNSYLVANIA STATE BOARD OF HEALTH.

I have received from the State Board of Health of Pennsylvania its Constitution and By-Laws, Circular No. 7, Precautions against Cholera, Circular No. 8, Precautions against Small-pox, and a circular "Regulations of Travel and Traffic," in which the Secretary, as executive officer of the Board, is directed to stop at the State line any infected persons or goods, and to cause horough isolation and disinfection.

MASSACHUSETTS STATE BOARD OF HEALTH.

Mr. Chas. F. Donnelly, president of the State Board of Health, Lunacy and Charities of Massachusettss, has expressed his views in regard to the merits and demerits of our present system and organization of State boards of health. (*Pharmaceutische Runbschau,* Feb., 1886, p. 26.) He thinks there is no especial reason why a State board of Health should be made up of physicians. "A State board of health made up principally of physicians would have to depend like laymen upon borrowed knowledge from the engineer, the chemist, the biologist, the architect or builder, the practical plumber and constructor of public and private works." But if they were not physicians they would also have to depend upon borrowed knowledge of the dangerous contagious diseases, and of much which should constitute the daily work of the office of a State Board of Health.

QUARTER ENDING WITH SEPTEMBER, 1886.

PENNSYLVANIA STATE BOARD OF HEALTH.

The Pennsylvania State Board of Health has drafted and printed a "Model Ordinance for the Better Preservation of the Public Health in Cities and Boroughs in Pennsylvania," for adoption by the councils of the cities and borroughs. This proposed ordinance defines a nuisance, and treats of house refuse, garbage, slaughter-houses, cattle-yards, hog-pens, bone-boiling, privies, sewers, and house-drains; it enumerates the diseases dangerous to the public health, and provides how they shall be restricted; it has reference to milk adulteration, unwholesome food, cellars, vaccinations, instruction of school children in regard to infection, certificates of burials, sextons, and cemetery-keepers.

This fourteenth Annual Report is respectfully submitted.

HENRY B. BAKER,
Secretary.

PRINCIPAL METEOROLOGICAL CONDITIONS IN MICHIGAN IN 1885.*

A COMPILATION OF REPORTS BY OBSERVERS FOR THE STATE BOARD OF HEALTH AND FOR THE UNITED STATES SIGNAL SERVICE.

COMPILED UNDER THE DIRECTION OF THE SECRETARY OF THE STATE BOARD OF HEALTH.

For each of the years 1877 to 1884, inclusive, there has been published in the Annual Reports of this Board a summary relative to the principal meteorological conditions as observed during the year. This paper continues the subject for the year 1885. The names of the observers for 1885 and the months for which copies of their registers of meteorological conditions were received from each are stated in Exhibit 1, page 9. In Exhibit 2, page 10, is given the latitude, longitude, and elevation of each station. In the tables which follow, reports received from any observer for less than half the year have not been used.

The principal conditions treated in the following tables are temperature and humidity of the air, cloudiness, rainfall, ozone, velocity and direction of the wind, and pressure of the atmosphere. The tables on each subject are illustrated by diagrams representing to the eye variations in the given condition from month to month through the year, at the several localities represented.

These tables give not only meteorological conditions for the year and month under consideration, but they also contain, for purposes of comparison, statements of the average conditions for the longest period available in each case.

USES OF METEOROLOGICAL STATISTICS.

Though the physical surroundings of man—the phenomena of "earth, air,

* An article in this Report, based upon weekly reports of sickness in Michigan, may well be studied in connection with this article, the main purpose of which is to serve as bases for studies of the causes of diseases.

made vigorous effort to learn any possibie way in which cholera might have been brought into Pinconning. Immigrants had recently arrived in the vicinity, but none were from a place known to be infected. The men in the camp where the patient had been had not been outside the State, nor had Mr. Smith been out of the vicinity. As to fruits from the Mediterranean, oranges had been in the house, but the patient is not fond of oranges. He is fond of raisins, however, and has been in the habit of eating them uncooked. A box, partially emptied, in the house apparently came from Valencia, Spain, and the raisins were not coated with sugar, but were apparently fresh, probably of the crop of 1885, at which time cholera is known to have prevailed extensively in Valencia. Whether there is any connection between the box of raisins and the case of sickness is yet problematical.

The water-supply in Pinconning is from wells, which are now (March 20) full nearly to the surface of the ground. There is not much purification of the water by filtering through the few feet of sand and sawdust which covers the clay. One well in front of a public house is about thirty-five feet from that part of the railroad track which is under the closet of the passing cars, so that if there should chance to be any dropping from the closet of a passing car, it might with the spring rain be washed almost immediately into the well and be quite freely distributed to those who drink from that well. There is no evidence connecting it with this case of sickness, but that is not a very safe well to drink from, and might be liable to be infected if any infectious disease should pass through on that railroad. The character of the soil and its relations to the soil-water used for drinking purposes in Pinconning render it very important that there should be thorough disinfection of all infectious discharges thrown into privies or upon the surface of the earth. The officers and members of the local board of health told me they were in the habit of thoroughly disinfecting privies every spring. I urged upon them the importance of doing this with special thoroughness this spring, and also the importance of prompt disinfection of the privy and surroundings at the residence of the patient whom I went to visit.

HENRY B. BAKER.

QUARTER ENDING JULY 13, 1886.

About 6,000 copies of circulars on the prevention and restriction of the dangerous communicable diseases have been sent to localities in Michigan where communicable diseases were reported to be present.

Returns of names and addresses of health officers in Michigan for 1886–7 have been received and filed. and a list of such health officers has been made ready for printing.

The secretary made a visit to Coldwater on June 17 for the purpose of meeting a citizens' committee on sanitary convention. The convention was fixed for Sept. 23 and 24, but has since been changed to Sept. 9 and 10. Announcements of the proposed Coldwater convention have been printed and distributed. Much work has been done in the way of supplying authors of papers to be read before such conventions with literature from the library of the Board bearing on their subjects.

The meteorological tables for the year 1885, to be printed in the report for 1886, are nearly completed.

A copy of the record of the meteorological observations taken at this office has been sent each month to the chief signal officer at Washington, D. C., as

and water"—have been the subject of observation and speculation by the philosophers of all ages, the real nature of their influence on man has but recently and partially been discovered, while the value of such knowledge is still imperfectly appreciated. The wind was thought by the Greeks to be the breath of a god, and in the Middle Ages the dew was looked upon as the product of the stars, and was collected by the alchemists as sacred. If it be thought strange that so little is now known concerning meteorological conditions, it may be mentioned that it was not known that the atmosphere had weight until the time of Galileo, and the thermometer and barometer, instruments for measuring the temperature and weight of the atmosphere, are only two hundred years old. The presence of something, which we now know as ozone, was indistinctly known to Homer, who spoke of the thunderbolt of Jove as "full of sulphurous odor," but its nature was not known until 1839, when Schönbein discovered it while engaged in experiments with electricity. After his experiments ozone was called "electricized oxygen." Very little comparatively is yet known concerning the great power of electricity and the effect of electrical conditions on health and disease; but it is acknowledged to be an important factor, and that knowledge concerning it may ultimately be used for the prevention of disease is the hope if not the belief of all. Benjamin Ward Richardson, M. D., writing of the absence of electricity in the atmosphere when cholera is at its maximum, says: "If we consider that every living creature is as much an electrical machine as each cloud; that the earth itself is the largest and most powerful electrical machine of all; that all things are always exchanging their electricities with each other, and that lightning destroys myriads of insects as well as some animals and human beings, at a single flash, it is past contradiction that electricity must be a grand actor in every form of life, whether of health or disease."

Probably the greatest value of meteorological statistics is for use, in connection with statistics of sickness and of deaths, in studying the causation of human sickness and deaths, with the view to the avoidance of such causes, and the prevention of sickness and deaths. But the value of meteorological data which is most appreciated is their use in forecasting the weather. That it is now impossible to forecast the weather for a long period of time is probably due to the fact that not enough data have as yet been grouped on which proper inductions can be based. Most "predictions" for a long period have been based upon observation simply, and not on the inductions of science. Much has already been learned:—that areas of high pressure and of low pressure are moving generally in an easterly direction; the temperature of the area of high or low pressure compared with the average at different seasons of the year, the rate of motion of the storm center, etc. From the results telegraphed from the 129 stations to the U. S. Signal Service Department at Washington, predictions are now made for 24 hours, and these predictions are at the present time verified in eight cases out of ten.* It is hardly possible to estimate the value of these signals in warning of approaching storms, frosts and floods. They have considerable value as public health measures.

In regulating the size of a cistern fed by water from the roof, it is sometimes useful to know the approximate rainfall during certain portions of the year. In laying out the sewers and drains of a city or village it is necessary in order to provide for the proper size of conduits, to know the average rainfall and the greatest single rainfall in the given locality, and also the loss by

* Science, Dec. 26, 1884, p. 568.

evaporation and the amount of moisture entering into the soil and absorbed by vegetable life. It being known that the boiling point of water varies with the pressure of the atmosphere, and that the atmospheric pressure varies with the altitude, a boiling-point thermometer has been a convenient method of ascertaining the height of mountains. Much has been written concerning the periodicity of sun-spots, their effects on temperature and rainfall, and some have attempted to connect the 11 year period of maximum sun-spots with periodic labor depressions. It is simply a question of fact. If sufficient data could be collected on the subject to show such relationship, such a discovery, as has been said, would "give us a power of prediction in respect to coming seasons of the greatest value in all agricultural and commercial operations."*

A knowledge of meteorology is indispensable to the scientific farmer. Different soils absorb different amounts of water; there are also different degrees of evaporation in different soils. Siliceous sand absorbs water in least amount, and evaporates it most readily, while humus absorbs water in the largest amount and retains it longest†. Evaporation from the earth is also lessened if the earth be covered with leaves. If it is not generally known it should be, that an atmosphere saturated with vapor of water prevents the radiation of heat. Mr. Tyndall declares that "if the blanket of aqueous vapor over England were removed for one summer's night, the whole island would by morning be held in the iron grip of frost, on account of the rapid radiation from the earth's surface which such conditions would permit." ‡ In rainless deserts, though the sands at night are very cold, by day they are so hot that a match dropped upon them immediately ignites. On proper climatic conditions depend not only the health of the farmer but his crops as well, and some of these conditions can be largely controlled. It is generally believed by those who have given the subject most attention, that if the clearing of forests were to cease, the result would be a more equable day and night temperature, a greater annual rainfall, and a more equable distribution of the same throughout the year. As the tree absorbs more heat during the day than the open field, so it imparts more warmth to the air during the night.§ Concerning the influence of forests on rainfall, M. Becquerel, member of the French Institute, in an article on "Forests and their Climatic Influence" (translated for the Smithsonian Institution) sums up in the following words: "It has now been shown, 1st, that there exists a difference between evaporation on a naked and on a sodded soil; 2d, that there is such a difference also in regard to a sodded soil and a wooded one, with the advantage in favor of the latter, that it better facilitates infiltration of the water; 3d, that the quantity of water imbibed by the roots does not parch the soil, since after exhalation it again falls in the state of fog, dew or rain. Desiccation only takes place when the soil is exhausted."‖ A committee appointed by the legislature of Michigan, in a report, dated Feb. 12, 1867, declares that the cutting down of forests "just as we would attack any nuisance just to destroy it—this is mere vandalism, the destruction of treasures which the destroyer knows not how to prize."¶ A committee of the State Board of Agriculture appointed in 1867 to prepare a memorial to

* Science, Dec. 26, 1884, p. 564.
† Smithsonian Report, 1869, p. 399.
‡ Science, Sept. 10, 1886, p. 233.
§ Smithsonian Report, 1869, pp. 406-407.
‖ Smithsonian Report, 1869, p. 401.
¶ Report of the Michigan State Board of Agriculture, 1866, Appendix, p. 4.

the Legislature on this subject writes: "The momentous importance of this subject may be appreciated if we consider that within the last five years the damage to the wheat crop of our State alone, from lack of shelter, can hardly be less than many millions of dollars, while the loss of fruit trees and their products within that period from the same cause must at least be an equal sum."* Hon. Geo. P. Marsh, in his work entitled "Man and Nature," writes: "I greatly doubt whether any of the American States, except, perhaps, Oregon, has at this moment more woodland than it ought permanently to preserve, though, no doubt, a different distribution of the forests in all of them might be highly advantageous."† F. L. Oswald, M. D., writes: "In some of our Southern and Central States this limit has already been passed. The States of Ohio and Indiana, and the southern parts of Kentucky and Michigan, so recently a part of the great East-American forests, have even now a greater percentage of treeless area than Austria and the North-German Empire, that have been settled and cultivated for upwards of a thousand years."‡ France has adopted the plan of planting trees in rows 100 meters apart. The legislature of Connecticut has passed a law for the encouragement of planting trees,§ but while cutting down a tree is the work of an hour, to replace it is the work of years.

Is it true that the preservation of our forests would give us a more equable day and night temperature and a more equable rainfall? Would it protect us against the dry, southwest wind, and shield the soil from early frosts? Would it protect our winter wheat, and by bringing warmer nights save us from those fungi which destroy our fruit? Would it do away with drouths and hence with those insects that prey upon all vegetation? In order to answer these questions of such vital interest it is necessary to know the nature of the soil and subsoil, the direction of the prevailing winds, the average annual rainfall, the daily range of temperature, the quantity of water absorbed by different trees, and all those complicated relations which make up the science of meteorology.

Knowledge of meteorological conditions is most useful, however, because of the part they play as causes and preventives of disease, and while the data here collected may be of use to all in different studies, the main purpose of their compilation is to study the causation of disease.

SOME OF THE PROSPECTIVE USES OF METEOROLOGICAL STATISTICS IN STUDYING THE CAUSATION OF DISEASE.

In estimating the healthfulness of any given locality, or in considering any climate as causing different diseases, it is important to know not simply the latitude of the place, its temperature, or moisture, but all those meteorological conditions which go to make up "climate." It is also necessary to have these conditions for a long series of years as well as the exceptions to the rule. The climate of a place cannot be told from its latitude. How different the climates of Attica and Bœotia, and yet they were adjoining territories! How different the climates of Italy and Michigan, and yet they are situated in the same latitude. How different are the meteorological conditions in the so-called "peach belt" of Michigan from those in the interior of the State. Indeed, how different are the conditions on the high and dry

* Report Michigan State Board of Agriculture, 1866, Appendix, p. 2.
† Report Michigan State Board of Agriculture, 1866, Appendix, p. 5.
‡ Popular Science Monthly, Vol. 11, 1877, p. 388.
§ Report, Conn. B'd of Agriculture and Experiment Station, 1882, p. 123.

ground upon which the provident man builds his dwelling, from those in the adjoining low, cold, and damp valley in which the improvident man locates his house. Very often the temperature in Savannah is three or four degrees lower than in Boston or New York. "Climate" is the resultant of many meteorological conditions. There are not only belts of temperature but belts of barometric pressure. There are five systems of winds. Prof. Supan, in Petermann's Mittheilungen for 1879, even proposed abandoning the five zones of Parmenides for a system more in accordance with climatic facts.* The temperature is, however, the first and most important factor to be considered in studying the influence of any climate on health and disease. Said Geo. Stephenson: "It is the sun which works railways," and it is the sun which gives us rain, wind, and cloud, which sustains all vegetable and animal life, and which in its fluctuations causes many of those diseases which afflict mankind.

The etiology of disease rests upon many sciences, including microscopy and meteorology. If, so far, the greatest progress has been made with the microscope, and the germ has come to be looked upon as "the root of all evil," it must not be forgotten that there are many fatal diseases which are probably purely climatic. There are at present many diseases occupying a large middle ground where germs and climate are each claimed to exercise a controlling force. What causes malarial fever—the malarial germ of Laveran, the *bacillus malariæ* of Klebs and Crudelli, or is it a purely climatic disease dependent on fluctuations of temperature? What is this indefinite something called malaria? Is it simply *mal aria*—"bad air"—air laden with carbonic acid gas? This may be produced artificially as well as naturally. Not only is there a "valley of poison" in the Island of Java, but says M. G. Robinet, in the Revue Scientifique: "The combustion of illuminating gas in Paris (218,813,875 cubic metres) alone, produced last year a quantity of carbonic acid thirty-five hundred times more considerable than all the dead buried in the cemeteries during five years could give at the maximum rate of exhalation."† Is malarial or intermittent fever the result of one specific cause or of many causes which disturb in a similar manner the functions of the human body? England is declared to have become almost free from this disease since the introduction of better drainage, and yet this disease is often found where there are no marshes, on sandy and arid soils. This fever prevails in the desert plains of northwest India, and in the arid regions of other countries.‡ Concerning the geographical distribution of malaria, Sir Joseph Fayrer, M. D., etc., declares that it "may be said not to pass the isothermal line of 65 north and 30 south latitude; and not to appear when the diurnal range of temperature is below 60° Fahr."§ Is altitude a preventive of consumption, and if so, is it because the atmospheric pressure is less, or because the location is high above the home of disease germs?

Not only is there doubt about many diseases as to whether they are climatic or contagious, but meteorological conditions act in many ways as carriers and as promoters of disease, and as direct causes of disease. Many contagious diseases, which seem capable of propagating themselves at all times of year and in defiance of climate, are yet largely controlled by the climate. Thus, Drs. Buchan and Mitchell, from statistics covering a period of 30 years, 1845

* Elementary Meteorology, by R. H. Scott, M. A., F. R. S., p. 339.
† Malaria, what it means. Edwards, p. 38.
‡ Transactions, Epidemiological Society, London, Vol. 1, 1881-82, p. 20.
§ Trans. of the Epidemiological Soc., London, Vol. 1, 1881-82, p. 16.

to 1874, showed that small-pox in London reached its maximum in May, its minimum in September, and was above the average from Christmas to the end of June.* No one, however, denies that small-pox is a germ disease. Yellow fever and cholera are germ diseases, yet it is alleged that they never co-exist, because yellow fever requires a moist and cholera a dry climate. Water-supply may occasion an epidemic of typhoid fever by becoming contaminated with the contagium of the disease, so infected clothing may be the method of carrying diphtheria germs from one locality to another, but both these diseases are largely dependent upon climatic conditions, the fever being most prevalent in times of drought and low water in wells, while diphtheria is more prevalent in cold than in warm weather. Again, a hot climate may aggravate unsanitary surroundings, and thus add to the malignancy of certain diseases.

Winds, a source of health in equalizing the temperature and bringing rain, may also carry the germs of disease. Hubert Airy, M. D., Medical Inspector to the Local Gov. Board (the general Board of Health for England), in an article on "The probability that the infection of diphtheria is sometimes transported by the wind," tabulates 30 different outbreaks to sustain this view. These outbreaks were gathered from the reports of the medical inspectors of the Local Government Board, and ranged from 1875 to 1880. In each of these outbreaks the date of first attack was exactly known, and "the outbreak could not be explained by reference to any of the known modes of diphtheria spread." In each outbreak the direction of the prevailing winds at the time of probable infection was given, and the distance of the place infected from some previously infected place from which the wind was blowing. Dr. Airy thus sums up the conclusions from these outbreaks: "Of thirty outbreaks thus examined twenty seem to satisfy the requirements of the wind theory, that is to say, within eight or nine days of the first attack, the wind was blowing (freshly) from a quarter in which diphtheria had recently prevailed, at an average distance of seven miles. In nine the agreement is doubtful as regards the probable source of infection, though the wind conditions as regards velocity appear favorable. In only one are the wind conditions apparently inadequate. * * * In examining these cases one cannot help being struck by the frequency with which we find the date of an outbreak of diphtheria preceded, at an interval of a few days (averaging three to six), by a breeze of more than average daily velocity."† Dr. Airy also cites an instance where small-pox infection was carried by the wind "a distance of two hundred yards from a cottage where some infected bedding and clothing was being burnt after a death from small-pox to another cottage somewhat higher up on a hill." In these cases the wind acted simply as the carrier of disease germs. It is also known to modify and intensify the symptoms of other diseases. Thus, according to Dr. Benj. W. Richardson, "the southwest wind is known to be unfavorable to acute inflammatory conditions; the north and northeast winds to neuralgic and rheumatic conditions; while the drying, cutting, depressing east wind is fatal to those in whom the store of vital energy is very low."‡ Independently of other meteorological conditions, the wind is therefore a cause of sickness. But much remains to be learned concerning its influences.

Many hold pneumonia to be a germ disease, but statistics, gathered by the

* Journal of the Scottish Met. Soc., 1874-5, p. 193.
† Trans. Epidem. Society, London, Vol 1, 1881-82, p. 58.
‡ Preventive Medicine, Richardson, p. 556.

Secretary of this Board, of over 5,400 deaths in Michigan and 31,000 weekly reports of sickness as well as 154,500 observations of temperature in this State during a period of eight years, and also a large number of statistics of deaths and sickness from pneumonia in other States and countries, show this disease to be controlled absolutely by the temperature, pneumonia rising as the temperature falls. Though it is possible that the cold weather simply causes conditions in the air-passages favorable for the germ of the disease, the fact that it never seems to vary much from the temperature would go to indicate that it belongs to that class of diseases purely climatic. Other meteorological conditions bear close relations to this disease, wind and ozone particularly so; but the temperature is the controlling factor. In the office of the State Board of Health diagrams have been made representing pneumonia and many different meteorological conditions, exhibiting graphically to the eye the average curve made for a series of years; and so far as relates to the several meteorological conditions, these diagrams are as useful for the study of other climatic diseases as of pneumonia.

A high mortality among children in the summer time has long been a matter of observation. Buchan and Mitchell showed that in New York City the mortality of children under one year of age was more than twice as great during the month of July as in any other month except August. The mortality of children between one and two years of age was also larger in July than in any other month. Among old people the danger of dying is greater in winter.* Dr. Wm. Farr some time ago showed that after twenty years of age the danger of dying from a fall of temperature was doubled every nine years.† Buchan and Mitchell divide the year into six periods, each of which has a climate (different temperature or moisture) and certain diseases peculiar to itself. Thus, in the first three periods (covering time from the fourth week of October to the second week of April) which are cold, rheumatism, heart disease, brain disease, diseases connected with the nervous system, and diseases of the respiratory organs, show a greatly increased mortality. In the last three periods (covering time from third week of April to the third week of October) which are warm, remittent fever, diarrhea, debility, dysentery and cholera attain their highest annual mortality.‡

But it may be asked, aside from the pleasure of knowing the causes of diseases, of what practical value is this knowledge? The seasons will continue to come and go; we cannot hope for July weather in December, or to control those forces of nature which are beyond our reach. We can, however, control the conditions of temperature indoors, and most people are in the house more than half of the time; and it is always easier to prevent a disease whose cause we know. That man can take best care of his health who best knows the causes of sickness. Many of these conditions are largely under the control of man. The unhealthfulness of some localities and the healthfulness of others have long been recognized. There are different climates which are better for different affections, as different meteorological conditions cause different diseases. Yellow fever does not thrive beyond the frost line. The influence of the sea in modifying the extremes of climate can be easily seen from an inspection of the map. If it be found to be true, as some have claimed, that the deaths from consumption are very much less at sea than on land, this should be a useful fact when we remember that consumption prob-

* Journal of the Scottish Met. Soc., Nos. LV-LVI., p. 187.
† Preventive Medicine, Richardson, p. 546.
‡ Preventive Medicine, Richardson, pp. 546-549.

ably causes in Michigan alone, on the average, about 3,000 deaths each year. The high altitude of mountains is also supposed by some to exercise a similar influence upon this disease.* If typhoid fever is concomitant with low water in wells, and cholera reaches its maximum when there is little rainfall, people, especially at such periods, can refrain from drinking water which has not been boiled; and can take such other measures as may be necessary to prevent these diseases. People can regulate not only the temperature but also the humidity of living rooms. Too much humidity checks the proper evaporation from the body, and too little humidity excites too much evaporation. Wm. Macfarlane, M. D., says that "the difference between the dry and the wet-bulb thermometer should not exceed here [in Scotland] 6°; it often reaches 8 or 9."†

If climatic diseases have not as yet been prevented, it is because sufficient data have not yet been gathered on which to base scientific inductions, or because what is now known to a few has not as yet become generally known among the people. It is impossible to tell out of just what statistics truth will first dawn upon the world. Particular exceptions are as useful as the general rules. Thus, in a study of the relationship between typhoid fever and low water in wells, it was noticed that the relationship held throughout the year 1881, except in the month of March. There was a falling off of typhoid fever in March, but the water in wells was low. It was thought that this might be due to the great depth to which the ground was frozen, thus protecting the wells from the germs of the disease. On turning to the reports of the meteorological observers for the Michigan State Board of Health, it was found that during the month of February it was reported that the "ground was frozen four feet deep," and in March the ground was reported to be "frozen to the depth of 18 inches." "A very wintry March," etc.‡ These facts, which are reported by observers to the State Board of Health, might be thought by some to be useless facts from which no good could ever come, yet in this case they supplied, apparently, the "missing link" in discovering the controlling cause of this disease. Every such fact, no matter how isolated, may be of value.

---

* Climatology and mineral waters of the United States. Bell, p. 92.
† Sanitary Journal, Vol. 3, 1880, p. 270.
‡ Typhoid fever and low water in wells, Baker, pp. 97-98.

EXHIBIT 1.—*Names of observers whose Reports are summarized in the following Meteorological Tables and Diagrams, their Places of Observation, and the Counties and Geographical Divisions of the State in which these Places are situated, and months for which reports were received from each observer.*

Name of Observer.	Place of Observation.	County.	Divisions of the State.*	Months (inclusive) for which Registers were Received.
F. M. Neal, Sergt. Signal Corps, U. S. A.	Marquette	Marquette	U. P.	March.
W. W. Dent, Sergt. Signal Corps, U. S. A.	Marquette	Marquette	U. P.	April to December.
Arthur Beebe	Manistique	Schoolcraft	U. P.	January to December.
L. M. Pindell, Sergt. Signal Corps, U. S. A.	Escanaba	Delta	U. P.	January to December.
G. H. Cleveland, M. D.	Moorestown	Missaukee	N. W.	January to May.
S. E. Wait	Traverse City	Gd. Traverse.	N. W.	January to December.
A. W. Nicholson, M. D.	Boyne City	Charlevoix	N.	January, March to Dec.
D. B. Notson, Sergt. Signal Corps, U. S. A.	Mackinaw City	Cheboygan	N.	January and February.
H. H. Kimball, Sergt. Signal Corps, U. S. A.	Mackinaw City	Cheboygan	N.	March to June.
Geo. M. Chappel, Pv't. Signal Corps, U. S. A.	Mackinaw City	Cheboygan	N.	July to December.
James J. Fitz Gerald, Sergt. Signal Corps, U. S. A.	Alpena	Alpena	N. E.	January to December.
D. W. Mitchell, M. D.	Harrisville	Alcona	N. E.	January to December.
Joseph E. Mueller, Sergt. Signal Corps, U. S. A.	Grand Haven	Ottawa	W.	January to December.
Fred Sweet	Grand Rapids	Kent	W.	Jan., March, and April.
John P. Stoddard, M. D.	Muskegon	Muskegon	W.	June to October.
G. H. Cleveland, M. D.	Pentwater	Oceana	W.	September to Dec.
E. S. Richardson, M. D.	Reed City	Osceola	W.	January to December.
John J. Granville	East Saginaw	Saginaw	B. & E.	September to Dec.
Jno. W. Kimball	Port Austin	Huron	B. & E.	January to December.
M. H. Perry, Sergt. Signal Corps, U. S. A.	Port Huron	St. Clair	B. & E.	January to July.
Wm. M. Edmondson, Corp'l Signal Corps, U. S. A.	Port Huron	St. Clair	B. & E.	August to December.
John S. Caulkins, M. D.	Thornville	Lapeer	B. & E.	January to December.
Prof. R. C. Kedzie	Agricult'l College, near Lansing	Ingham	C.	January to December.
Rev. J. Pierson, D. D.	Ionia	Ionia	C.	January to April.
Gordon A. Willett	Ionia	Ionia	C.	May to August.
J. W. Ewing	Ionia	Ionia	C.	September to Dec.
Howard M. Holmes	Office State B'd of Health, Lansing	Ingham	C.	January to July 22.
E. H. McCallum	Office State B'd of Health, Lansing	Ingham	C.	July 22 to December.
G. G. Gordon, M. D.	Swartz Creek	Genesee	C.	January to December.
Prof. M. W. Harrington	Ann Arbor	Washtenaw	S. C.	January to December.
J. H. Kellogg, M. D.	Battle Creek	Calhoun	S. C.	January to December.
F. D. Parmelee	Hillsdale	Hillsdale	S. C.	January.
Lieut. A. H. Boies	Hudson	Lenawee	S. C.	Jan. to Aug., Oct. to Dec.
Geo. C. Palmer, M. D., Supt.	Asylum for Insane at Kalamazoo	Kalamazoo	S. C.	January to December.
W. T. Drake	Marshall	Calhoun	S. C.	January to December.
Lewis Marvill	Parkville	St. Joseph	S. C.	January to December.
L. G. North, M. D.	Tecumseh	Lenawee	S. C.	January to December.
S. Alexander	Birmingham	Oakland	S. E.	March to December.
Norman B. Conger, Sergt. Signal Corps, U. S. A.	Detroit	Wayne	S. E.	January to December.

* The counties in each division are stated in Exhibit I, in the article on weekly reports of sickness.

EXHIBIT 2.—*Latitude and Longitude, Elevation above Sea Level, and the Average Temperature, and Average Barometric Pressure in 1885, at 21 Meteorological Stations in Michigan—the names of the Stations being arranged in order by latitude, highest first.*

Localities in order of Latitude, those farthest North, first.	Latitude North.	Longitude West from Greenwich.	Altitude (Approximate) above Sea Level,—Feet.	Height of Mercury in Cistern of Barometer above Sea Level,—Feet.	Average Temperature, 1885. Degrees Fahr.	Average Atmospheric Pressure, 1885. Inches of Mercury corrected for Temp.
Marquette	46°34′	87°24′	¶ 638.07	668.8	....	....
Manistique	45°58′	86°15′	596.	[b] 600.	38.28	29.294
Mackinaw City	45°47′	84°39′	[c] 582.	605.	38.03	29.300
Escanaba	45°46′	87°14′	[d] 594.693	e 613.	37.57	29.288
Alpena	45°5′	83°28′	589.	609.5	37.83	29.291
Traverse City	44°45′	85°40′	598.	602.5	40.50	29.315
Harrisville	44°39′	83°18′	....	....	41.01	29.262
Port Austin	44°	82°	[f] 479.	....	41.69	29.322
Reed City	43°44′	85°28′	1,016.	1,022.	40.24	28.916
Grand Haven	43°5′	86°18′	595.3	620.	42.94	29.312
Ionia	† 42°59′	† 85°4′	688.1	[g] 700.	43.91	29.229
Port Huron	42°58′	82°29′	[h] 600.	633.	41.75	29.298
Swartz Creek	42°57′	83°49′	800.	....	42.67	29.147
Thornville	* 42°55′	* 83°10′	‖ 975.	980.	44.93	28.911
Agricultural College	42°44′	84°29′	820.	834.	42.90	29.066
Lansing	‡ 42°44′	‡ 84°33′	[a] 900.	[a] 917.	43.01	29.041
Birmingham	42°30′	83°10′	§ 752.	....	....	....
Detroit	42°20′	83°2′	[i] 602.6	661.43	46.94	29.290
Battle Creek	* 42°20′	* 85°11′	§ 800.	....	46.72	28.809
Ann Arbor	42°17′	83°44′	930.	936.	43.40	28.991
Marshall	42°17′	84°58′	885.	888.	46.04	29.005
Kalamazoo	42°13′	85°35′	975.	[j] 987.	44.36	28.917
Tecumseh	* 42°1′	* 83°57′	835.	837.5	44.79	29.102

* Estimated from lines on a map of Michigan issued by the General Land Office, Department of the Interior, 1878. For stations having no reference mark, the latitude and longitude were stated by the observer on the meteorological reports received.

† The exact latitude and longitude of the astronomical post at Ionia is 42°58′ 52.53″ N. and 85°3′ 49.20″ W.

‡ The exact latitude and longitude of the astronomical post placed in the ground near the new Capitol at Lansing, by the U. S. Lake Survey in 1875, as determined by the observations then made, is 42°43′ 53.11″ N. and 84°33′ 19.68″ W.

§ Estimated from data on "Railroad Profiles," pages 179–187, Annual Report of the State Board of Health for 1878.

‖ Estimated from data in Tackabury's Atlas of the State of Michigan.

¶ At Marquette after August 1 the approximated altitude is given as 641.4 ft., and the height of mercury in cistern of barometer 671.8 ft.

[a] Estimated from comparisons of barometrical observations at Lansing, Port Huron, and Grand Haven, for the four years, 1879–82.

[b] 602.8 in December.

[c] 588 in March, July, August, September, October, November, and December.

[d] 587.7 in September, October, November, and December.

e 608 in September, October, November, and December.

[f] 478 in September, 472 in November and December.

[g] 680 from May to August, inclusive; 786.6 after September 1.

[h] Stated to be 630 in February and 603 in December.

i 585 in August, September, October, November, and December. [j] 985 in November.

NOTE.—Green's standard barometer was used at the above stations for the year 1885, Kalamazoo excepted. The barometer at Kalamazoo was manufactured by J. Foster, Cincinnati, Ohio.

METEOROLOGICAL CHARACTERISTICS OF THE YEAR 1885, AT ONE CENTRAL STATION.

At the State Agricultural College, near Lansing, and near the centre of the thickly settled part of the State, the average temperature for 1885 was 2.76° lower than for 1884, and 3.74° lower than the average for the preceding 21 years; the annual range of temperature was 1° less than in 1884, and 1° greater than the average annual range for the preceding 12 years; the average monthly range of temperature was 5° less than in 1884, and 3° less than the average for the 12 preceding years; the average daily range of temperature was .94° less than in 1884, and 1.82° less than the average for the preceding 11 years; the average cloudiness was the same as in 1884, and equal to the average for the preceding 21 years; the rainfall (rain and melted snow) was 1.28 inches less than in 1884, and 2.65 inches more than the average for the preceding 21 years; the average atmospheric pressure was .019 inches less than in 1884, and .011 inches greater than the average for the preceding 10 years. In Exhibit 3, pages 112–113, is given by year and months, a comparison of conditions in 1885, at the Agricultural College, with those in 1884, and with average for periods of years. December, November and July (naming months in order of greatest difference), were months in which the average temperature in 1885 was higher than the average for corresponding months in the preceding 21 years; February, March, January, August, October, June, May, April and September were months in which the average temperature in 1885 was lower than the average for corresponding months in the preceding 21 years, at that station, which is near the central part of the State.

Whoever will carefully study Diagram No. 1 in this article and in similar articles for preceding years, will see that thermometers and methods of observation have become so perfect that, given a curve representing correctly the temperature by months at one station in Michigan, curves can readily be constructed without actual records which will somewhat closely represent the temperature at each of several other stations, because the curves for many stations run so nearly parallel that all that is necessary to do is to find the average difference of mean annual temperature at the station to be represented compared with the station for which the data are given. It may also be seen that a curve representing the temperature at a station in the central part of the State very closely resembles the curve representing the average for many stations representing nearly all parts of the State. This proves that the practice adopted many years ago of stating the meteorological characteristics at one central station is a reasonably safe practice, and it is especially useful when it enables us to gain a comparison for a longer period than can be made from records at many stations, and also when employed in advance of the receipt of records from all stations, as is the case when the weekly bulletins of "Health in Michigan" are issued, for the purposes of which the meteorological conditions at the State Capitol are used to represent the conditions probably prevailing throughout the State.

EXHIBIT 3.—*Statements of Meteorological Conditions in the Year and in each Month of the Year, 1885, Compared with Annual and Monthly Averages for 1884, and for several Stated Periods of Years,—from observations by Prof. R. C. Kedzie, at the State Agricultural College near Lansing, Michigan.*

Meteorological Conditions.	1885 Compared with Averages for Previous Years. No. of Years Averaged, endi'g with 1884.	1885 Compared with Averages for Previous Years. More (+), or Less (-), in 1885 than the Average for Previous Years.	In 1885 More (+), or Less (-), than in 1884.
YEAR 1885.			
Av. Temp	21	-3.74°	-2.76°
Range of Temp*	12	+1°	-1°
Av. Monthly Range of Temp*	12	-3°	-5°
Av. Daily Range of Temp*	11	-1.82°	-0.94°
YEAR 1885. *Continued.*			
Cloudiness	21	0 per ct.	0 per ct.
Rainfall	21	+2.65 in.	-1.28 in.
Atmospheric Pressure	10	+.011 in.	-.019 in.
JANUARY.			
Av. Temp	21	-6.76°	-0.12°
Range of Temp*	12	+6°	-2°
Av. Daily Range of Temp*	11	+0.48°	+0.56°
Cloudiness	21	+3 per ct.	-2 per ct.
Rainfall	21	+1.00 in.	+1.47 in.
Atmospheric Pressure	10	+.064 in.	+.026 in.
FEBRUARY.			
Av. Temp	21	-15.58°	-14.49°
Range of Temp*	12	+10°	- °
Av. Daily Range of Temp*	11	+5.40°	+8.22°
Cloudiness	21	-16 per ct.	-36 per ct.
Rainfall	21	-1.31 in.	-2.96 in.
Atmospheric Pressure	10	-.061 in.	-.075 in.
MARCH.			
Av. Temp	21	-10.27°	-8.63°
Range of Temp*		-4°	-13°
Av. Daily Range of Temp*	11	.62°	+1.59°
Cloudiness	21	-11 per ct.	-9 per ct.
Rainfall	21	-2.10 in.	-3.09 in.
Atmospheric Pressure	10	+.090 in.	+.022 in.
APRIL.			
Av. Temp	21	-2.02°	-0.07°
Range of Temp*	12	+2°	+11°
Av. Daily Range of Temp*	11	-3.97°	-2.36°
Cloudiness	21	+4 per ct.	+3 per ct.
Rainfall	21	-0.03 in.	+0.52 in.
Atmospheric Pressure	10	+.093 in.	+.086 in.
MAY.			
Av. Temp	21	-2.45°	-1.14°
Range of Temp*	12	+2°	+7°
Av. Daily Range of Temp*	11	-4.17°	-1.45°
Cloudiness	21	+5 per ct.	+5 per ct.
Rainfall	21	-0.87 in.	-1.65 in.
Atmospheric Pressure	10	-.054 in.	-.007 in.
JUNE.			
Av. Temp	21	-3.19°	-4.23°
Range of Temp*	12	-6°	0°
Av. Daily Range of Temp*	11	-0.52°	-1.57°
Cloudiness	21	-7 per ct.	+2 per ct.
Rainfall	21	+1.72 in.	+3.18 in.
Atmospheric Pressure	10	+.080 in.	-.151 in.

* By registering thermometers, set at 7 A. M., and recorded at 7 A. M., for the preceding calendar day.

EXHIBIT 3.—CONTINUED.—*Meteorological Conditions at the Agricultural College, in Months for the Year 1885, Compared with Averages for Corresponding Months in Preceding Years.*

Meteorological Conditions.	1885. Compared with Averages for Previous Years. No. of Years Averaged, endi'g with 1884.	1885. Compared with Averages for Previous Years. More (+), or Less (-), in 1885 than the Average for Previous Years.	In 1885 More (+), or Less (-), than in 1884.	Meteorological Conditions.	1885. Compared with Averages for Previous Years. No. of Years Averaged, endi'g with 1884.	1885. Compared with Averages for Previous Years. More (+), or Less (-), in 1885 than the Average for Previous Years.	In 1885 More (+), or Less (-), than in 1884.
JULY.				AUGUST.			
Av. Temp.	21	+1.25°	+4.75°	Av. Temp.	21	-5.40°	-3.29°
Range of Temp.*	12	-4°	-2°	Range of Temp*	12	-12°	-12°
Av. Daily Range of Temp*	11	-2.47°	-2.25°	Av. Daily Range of Temp*	11	-6.59°	-4.81°
Cloudiness	21	-3 per ct.	-3 per ct.	Cloudiness	21	+6 per ct.	+16 per ct.
Rainfall	21	-1.12 in.	-0.08 in.	Rainfall	21	+3.15 in.	+4.52 in.
Atmospheric Pressure	10	+.003 in.	+.048 in.	Atmospheric Pressure	10	-.010 in.	-.059 in.
SEPTEMBER.				OCTOBER.			
Av. Temp.	21	-1.46°	-6.12°	Av. Temp.	21	-3.50°	-5.96°
Range of Temp*	12	+12°	-8°	Range of Temp*	12	-3°	-4°
Av. Daily Range of Temp*	11	-3.33°	-1.60°	Av. Daily Range of Temp*	11	-2.76°	-2.30°
Cloudiness	21	-5 per ct.	+8 per ct.	Cloudiness	21	+1 per ct.	+7 per ct.
Rainfall	21	+0.87 in.	+0.41 in.	Rainfall	21	+0.41 in.	-2.65 in.
Atmospheric Pressure	10	+.012 in.	-.003 in.	Atmospheric Pressure	10	-.020 in.	+.028 in.
NOVEMBER.				DECEMBER.			
Av. Temp.	21	+1.95°	+3.11°	Av. Temp.	21	+2.29°	+3.04°
Range of Temp*	12	-14°	-8°	Range of Temp*	12	-1°	-23°
Av. Daily Range of Temp*	11	-3.84°	-4.24°	Av. Daily Range of Temp*	11	-1.72°	-1.14°
Cloudiness	21	+12 per ct.	+18 per ct.	Cloudiness	21	+6 per ct.	-5 per ct.
Rainfall	21	+0.67 in.	+1.06 in.	Rainfall	21	+0.23 in.	-2.01 in.
Atmospheric Pressure	10	-.072 in.	-.098 in.	Atmospheric Pressure	10	-.019 in.	-.065 in.

* By registering thermometers, set at 7 A. M., and recorded at 7 A. M., for the preceding calendar day.

Comments on Exhibit 3 are printed on page 11.

The unusually low temperature for February and March, and the uniform low temperature for the months January, April, May, June, August, and October, and the large amount of rainfall for August are especially noticeable.

LOCAL METEOROLOGICAL PHENOMENA IN THE SEVERAL MONTHS OF THE YEAR 1885.

The following general remarks relative to temperature, frosts, effects on vegetation, migration of birds, etc., in 1885, are taken from the monthly reports by observers. The names of observers are stated in Exhibit 1, page 9.

JANUARY.

Jan. 12. Ice formed in Harbor 3 inches thick. Jan. 13, ice broke up in Harbor. Jan. 15, thin ice in Harbor. Jan. 18, ice 7 inches thick in Harbor. Jan. 19, ice broke up in Harbor. Jan. 21, ice formed

9 inches thick in Harbor. Jan. 22, ice formed one-half mile from shore. Jan. 27, ice in Lake Michigan beyond limit of vision. Jan. 30, ice broke up in Lake Michigan. Jan. 31, ice 15 inches thick in Harbor.—*Manistique.*

Frosts Jan. 1 to 31 inclusive. Ice, Jan. 1 to 31, inclusive. Little Bay de Noquette frozen at close of month.—*Escanaba.*

Grand Traverse Bay froze over Jan. 26.—*Traverse City.*

Frosts Jan 2, 9, 10, 13, 14, 19, 20, 22, 28, 29, 31. Melting snow on ground Jan. 3 to 12, inclusive. Snowfall during the month 19.5 inches. Ground frozen 1 foot 6 inches at close of month.—*Alpena.*

Jan. 1, Grand River full of floating ice. Jan. 3, river opened during night. Frosts Jan. 8, 9. Jan. 13, river closed during night. Jan. 23, light thaw. Shore ice in Lake Michigan commenced drifting lakeward.—*Grand Haven.*

Jan. 17, severe snow storm in the night. Jan. 27, at 7 A. M., temperature was —13. At 9 A. M. it was —16. The month has been cold and a large amount of snow has fallen for this locality.—*Port Austin.*

The first half of the month was mild with nearly bare ground. The latter half was severe winter weather with good sleighing. Depth of snow at end of month about 20 inches. Ice on ponds 14 inches. In open grounds 20.—*Thornville.*

Frosts Jan. 9, 10.—*Ionia.*

Highest temperature during the month 45°, lowest, —27°. Depth of snow at end of month 18 inches. Frosts Jan. 2, 4, 8, 18, 19, 21, 26, 27, 30.—*Swartz Creek.*

Frosts Jan. 2, 3, 9, 14, 18, 19, 20, 28, 29, 31. Jan. 31, everything was covered with a thick coating of frost crystals.—*Ann Arbor.*

Jan. 5, melting snow on ground.—*Battle Creek.*

Frosts Jan. 8, 9.—*Grand Rapids.*

Frost Jan 31. January has been very severe on birds, quail suffering greatly from severe cold. Even owls, usually excessively fat, are as poor as can be.—*Hudson.*

Jan. 5, 6, 8, melting snow on ground. Jan. 27, temperature at 7 A. M. was —25°; at 8:30 A. M., —27°. Jan. 28, temperature at 6:30 A. M. was —30°; at 7 A. M. —31°, and at 7:30 A. M. —32°.—*Moorestown.*

River closed third time this season, Jan. 15.—*Lansing.*

FEBRUARY.

Feb. 5, ice 3 miles from shore. Feb. 8, ice 20 inches thick, and Feb. 16, 24 inches thick in Manistique Harbor. Feb. 22, ice 5 miles from shore. Feb. 27, first appearance of birds since December, a flock of martins.—*Manistique.*

Frosts, Feb. 1 to 28, inclusive. Ice Feb. 1 to 27, inclusive. Thaw Feb. 22, 23, 24, 26, 27, 28. Little Bay de Noquette frozen over.—*Escanaba.*

Frosts Feb. 6, 11, 13, 14, 17, 19, and 23 to 26. Melting snow on ground Feb. 3, 4, 24, 26, 27, 28. Ground frozen 2 feet 8 inches.—*Alpena.*

February has been the coldest month known since the county was settled. More snow has fallen this winter than fell in the same length of time during any previous winter. Roads are badly blockaded.—*Port Austin.*

February has been one of the coldest months on record, the mean temperature being about 14° below normal. A noteworthy circumstance for this latitude is, that there were two days in which the mercury was continuously below zero with a mean for the two days of —8⅜°. During the first week the roads were good, but the blizzard which began on the 9th drifted them up so completely that all travel was suspended for some days. East and west roads were soon tracked, but north and south remain permanently blocked except where they have been shoveled, compelling travel to go through fields.

Barometrical pressure was unusually low. It is not believed that the wheat and clover are much injured by the severity of the cold, being generally well covered with snow; but peach buds are probably all killed. Cellars have frozen to a greater extent than ever known, and fears are entertained for the safety of potatoes in pits. Ice on still water at the close of the month is about 3 feet thick and frost in the ground the same where the snow has blown off. In the woods it is not deep. It is likely that the month will be remembered as the cold February, for many years to come.—*Thornville.*

Melting snow on ground, Feb. 3, 4, 24 to 28.—*Ionia.*

Frosts Feb. 5, 11, 12, and 18 to 24, inclusive. Between 9:30 P. M. Feb. 15, and 7 A. M. Feb. 16, the temperature fell 36°; and from 9 P. M. Feb. 15, to 9 P. M. Feb. 16, it fell 48°. Ground frozen about 5 inches. The temperature was below zero on 21 days during the month, 17 being in succession.—*Swartz Creek.*

Feb. 15, wind shifted from south to west about 9:30 P. M., and the temperature fell 12° in half an hour. Frosts occurred on every clear morning during the month. A most intensely cold month. Ground frozen to the depth of several feet, and Huron frozen over all the month.—*Ann Arbor.*

Melting snow on ground Feb. 18, 19, and 23 to 28, inclusive.—*Battle Creek.*

Frost, Feb. 3. Melting snow on ground Feb. 23, 24, 27, 28.—*Moorestown.*

This has been the coldest month ever known in this section, 16 consecutive days the thermometer registered below zero.—*Hudson.*

MARCH.

March 9, English sparrows appeared. March 13, first crows since November. March 27, ground frozen 29 inches in cemetery. March 31, ice 16 inches thick in harbor; no water visible in Lake Michigan. Two men crossed on the ice from Beaver Island to Manistique, and report no water visible from Beaver Island. March temperature was 6.5° colder than corresponding month in 1884.—*Manistique.*

Frosts, March 1 to 31, inclusive. Ice, March 1 to 31, inclusive. Thaw, March 1, 3, 9, 13, 22, 23, 24, 27 to 31.—*Escanaba.*

Frosts, March 2, 7, 8, 16, 18, 20, 22, 23, 29. Thaws, March 26, 27, 30, 31.—*Mackinaw City.*

Frosts, March 6, 7, 8, 16, 17, 18, 19, 22, 23, 25, 28, 29. Melting snow on ground, March 1 to 5, 9, 10, 11, 14, 15, and 23 to 31, inclusive. Ground frozen about 3 feet, 6 inches.—*Alpena.*

Frosts, March 2, 6, 8, 10, 11, 19, 28, 29. Thaws, March 3, 9, 25, 26, 27, 31. Wild geese flying southeast March 29.—*Grand Haven.*

Robins out on March 10.—*Parkville.*

March 20, trees heavily laden with frost. March 23, the ice is solid outside the lighthouse.—*Port Austin.*

Dates of return of migratory birds first seen, March 26, robins; March 28, bluebirds; March 31, flycatcher and chipping sparrow. March has been a month of severe winter, the mean temperature having been 10° lower than the normal. There were 10 nights with a minimum of zero or below. Sleighing continued till the last day of the month. At the close the ice is all in the ponds; frost in the ground in unprotected places is 3¼ feet thick; snow in the woods hardly at all melted, and nearly all north and south roads are obstructed. Where the snow is melted on the wheat fields (about half) the crop is seen to be uninjured by the winter, and to present a splendid promise. Further examination of the peach buds shows that they are all killed. Apple trees are hurt in the bark by the severity of the cold.—*Thornville.*

Melting snow on ground March 1 to 6, 9, 11, 14, 24 to 31. Birds first heard and seen, March 24, robin; March 31, blackbirds and meadow larks. Depth of snow at close of month averages 6 inches.—*Ionia.*

Frosts, March 5, 7, 10, 13, 15, 16, 18, 20, 21, 22, 24, 31; March 29, robins first seen; March 30, killdeers first seen. About 10 inches of snow remain in forests. Open fields about one-third covered. Wheat has been well protected and is in good condition.—*Swartz Creek.*

Frosts, March 2, 6, 8, 10, 11, 12, 17, 19 to 23. As the month entered a few small bare spots of earth were visible, but the ground was mostly covered with snow from a few inches to several feet in depth. On the 2d the earth received another covering, but on 4th and 5th a few bare spots were again visible. On the morning of the 7th three inches more of snow covered everything. By the 9th a few spots of earth were again visible, while ice formed from the melted snow covered the earth at other places. It remained in this condition (on account of the extremely cold weather) until the 24th, when another thaw set in, and by the 28th the snow had all melted except on the hill-sides facing north and other sheltered places. Another snow covered the earth on the 30th, but this had almost entirely disappeared by the night of the 31st.—*Ann Arbor.*

Melting snow on ground March 1, 3, 4, 5, 7 to 16, 18 to 31.—*Battle Creek.*

Frosts, March 2, 8, 21 to 24, 28, 29.—*Grand Rapids.*

Hawks made first appearance March 24; robins and blackbirds March 25; bluebirds and other songsters have come, March 29. Peach trees and field mice nearly all killed.—*Birmingham.*

Melting snow on ground March 1, 2, 3, 7, 26 to 31. March 23, temperature at 7 A. M. was —22°, at 12 (noon) it was 28°, being a variation of 50° in 5 hours.—*Moorestown.*

First crows seen March 2; first robin heard March 27; first blackbirds seen March 30. Ice in Grand River at this point 20 inches thick about middle of March. Very little sleighing.—*Lansing.*

APRIL.

Frosts, April 1, 6, 17, 19, 24, 25. April 7, wild geese flying north. April 14, open water seen. April 21, robins appeared. April 28, ice went out of harbor.—*Marquette.*

April 5, open water appeared in Lake Michigan 4 miles from shore. April 10, gulls appeared. April 17, Manistique River open. April 20, robins appeared. April 21, wild geese flying north. April 22, swallows appeared. April 23, Lake Michigan open. April 27, first boat, steamer "Minnie M." from Chicago. April 29, frogs first heard. Melting snow on ground April 16 to 30.—*Manistique.*

Frosts, April 1 to 20, 22 to 30, inclusive. Ice, April 1 to 4, 7 to 14, 25, 27, 28. Thaw, April 1 to 11, 13, 15 16, 17. Monthly temperature of Little Bay de Noquette, surface 34.8°, bottom 34.3°.—*Escanaba.*

Frosts, April 3, 4, 6, 7, 9, 10, 14, 16, 17, 18, 19, 25. Melting snow on ground April 1 to 6, 13 to 18, 28, 29, 30. Frost disappeared from ground April 29. Navigation opened April 26.—*Alpena.*

Frosts, April 1, 6, 10. Thaw, April 1.—*Grand Haven.*

April 18, I went with a team two miles out on the ice. April 26, a steamer passed up. April 27, a number of craft passed up.—*Port Austin.*

Sleighing from April 11 to 15. Squalls of frozen rain April 18. Ice formed April 1 to 18, 24, 25, 27, 28. Frogs first heard April 14. Return of migratory birds, April 1, song sparrow and meadow lark; April 4, chewink and killdeer plover; April 30, bobolink. Growth of vegetation: April 22, hazel in

blossom, Missouri currant leafing, willow and soft maple budding; April 23, black raspberries leafing. A dry month, and excepting four hot days and nights (from April 20 to 23, inclusive) a very cold one, some nights wintry. The mean temperature of the month is about normal, but omitting the four above mentioned days it would fall near 5 below. The return of migratory birds was late and the growth of vegetation slow. The growing wheat on level grounds presents a superb appearance, but on the tops of knolls and on westerly slopes it is winter-killed to a considerable extent.—*Thornville.*

Frosts April 1, 4, 10, 25, 29. Trees in blossom: April 23, Acer Dasy carpum and Acer Rubrum. Ice went out of Grand River April 3. Honey bees among the crocuses April 19.—*Ionia.*

April 1, meadow larks; April 5, blue birds and Phœbe; April 16, wild geese flying north; April 17, frogs. Frosts April 3, 4, 8, 24, 28. Wheat looking well.—*Swartz Creek.*

Frosts April 1, 4, 6, 10, 25, 29. Average temperature of the month about normal. Ground reported frozen to the depth of two feet, about the middle of the month.—*Ann Arbor.*

All vegetation is about 3 or 4 weeks late. The willows did not blossom until the last days of the month. The same may be said of elms and maples. Their usual time for blossoming is about April 1, in this locality. On the last days of the month no insects had yet made their appearance. The honey bees have nearly all been killed by the hard winter.—*Birmingham.*

April 6, robins seen. April 30, snow seen only in patches in woods and ravines. Ice nearly out of lake.—*Boyne City.*

Frosts April 2, 4, 6, 10, 29.—*Grand Rapids.*

Frost April 29.—*Hudson.*

Melting snow on ground April 1 to 7, 9, 10, 11, 15 to 20, 28; April 15, tree-toads heard, maple sap beginning to flow; April 20, first frog heard; April 21, sleighing totally disappeared; April 24, frost all out of ground; April 29, three-eighths inches of ice formed on still water last night.—*Moorestown.*

Ice began moving in Grand River April 3. River opened April 4. First bluebird seen April 3; first meadowlark April 4. Bank swallows first seen April 12.—*Lansing.*

MAY.

Frosts May 2, 6, 19, 28.—*Marquette.*

Wild geese flying northeast May 3, flying northwest May 4. Trailing arbutus in flower May 9. Strawberries in flower May 31.—*Manistique.*

Frosts May 1 to 13, 18 to 20, 28. Ice May 1, 2, 3, 6, 11. First boat to arrive May 5. Monthly temperature of Little Bay de Noquette, surface, 46.3°; bottom, 44.5°.—*Escanaba.*

Frosts May 1, 3, 11, 12, 13. Melting snow on ground May 8, 9, 10.—*Alpena.*

Frosts May 1, 2, 6, 11, 13.—*Grand Haven.*

Ground frozen in the morning, May 2, 3, 4, 8, 9, 10, 11. White frosts, May 1, 3, 11. Growth of vegetation, willow leafing May 4, tamarack leafing May 5, strawberries begin to blossom May 6, basswood and elm leafing May 14, poplar leafing May 17, Juneberry blossoming May 17, plum and cherry blossoming May 18, apple trees blossoming May 21, white oak leafing May 26. Barn-swallows returned May 1. King bird returned May 11. Whippoorwill returned May 16.

May has been a cool month, with a considerable but unequally distributed rainfall. The extreme wetness of the soil, owing to heavy rains of the fore part of the month, made the work of getting in crops very backward, and at its close wheat is not headed out, corn is not up, and much is yet to be planted. The appearance of the growing wheat and clover is superb, but the percentage of winter killed is quite large. The season is in every respect late.—*Thornville.*

Hoar frost, May 11, 12, 15. Melting snow fell May 3, 8, 9.—*Ionia.*

Ice formed May 2, 3, 9, 10. Frosts, May 2, 3, 9, 10. Cherry and plum trees in blossom May 18. Apple trees in blossom May 21.—*Swartz Creek.*

Frosts, May 3, 4, 11.—*Ann Arbor.*

Frosts, May 11, 12, 13. Melting snow on ground May 8, 9. Ice one-half inch thick formed May 11. Wild geese flying north May 12.—*Moorestown.*

Frosts, May 2, 4. Hard freezing of ground and water May 11.—*Birmingham.*

Beech drops and May flowers in abundance. Ice in Pine Lake entirely disappeared, May 1.—*Boyne City.*

Ice formed in night, May 7. Frost, May 10.—*Lansing.*

Frost, May 13.—*Parkville.*

JUNE.

Light frost, June 21, 22.—*Swartz Creek.*

Hoar frost, June 9, 10, 22.—*Ionia.*

Fire flies first seen June 8. Wheat in head June 10. Locust in blossom June 11. Blackberries in blossom June 12. Slight frost in low places June 22. A fall in the temperature of 30° occurred between 1 P. M. and 3 P. M., June 28.

A cool month, with no very hot days and some really cold nights. The changes and great range of temperature have been quite unusual, and so has the wetness of the soil, although the weather has been very fine. Circumstances have favored the growth of wheat and grass, which are both very

heavy, but not the corn, which is rather small for its age. Oats look well, and so do potatoes. All kinds of fruit, except berries and pears, are a failure.—*Thornville.*

Frosts, June 9, 10, 22, 29.—*Grand Haven.*

Frost doing material damage June 29.—*Alpena.*

Frosts, June 8, 9, 22, 29. Temperature of Little Bay de Noquette, surface 59.5°, bottom 57.8°.—*Escanaba.*

Frost severe enough to destroy garden vegetables, June 8, 22, 29.—*Manistique.*

Light frost, June 8.—*Marquette.*

Light frost, June 23.—*Hudson.*

Light frost on low lands, June 30.—*Birmingham.*

Frosts, June 7, 8, 9, 30. Ripe strawberries, June 11.—*Boyne City.*

Frost, June 9.—*Lansing.*

Frost, June 9, 22.—*Parkville.*

JULY.

Wheat harvest begun July 17.—*Swartz Creek.*

A hot, sunshiny month, notable for its few rainy days and none entirely cloudy. The considerable precipitation all came in a few short thunder storms. The growth of vegetation has been extremely rapid, and the corn especially so, being now as forward as usual. Wheat cutting began July 18, and as the month ends the crop is about three-fourths secured in the very best condition. The yield and quality of the crop are exceptionally good.—*Thornville.*

Frost, July 11.—*Alpena.*

Monthly temperature of Little Bay de Noquette, surface 68.0°, bottom 66.6°.—*Escanaba.*

Frost, July 10.—*Boyne City.*

AUGUST.

Slight hoar frost in morning, August 14, 26.—*Ionia.*

It has been very hard getting spring crops; potatoes, peas, and corn are good.—*Port Austin.*

Light frost, August 24; no damage.—*Alpena.*

Frost, August 14.—*Traverse City.*

Frost, August 25. Monthly temperature of Little Bay de Noquette, surface 64.8°, bottom 63.5°.—*Escanaba.*

Frosts, August 15, 25, 26.—*Manistique.*

Frosts, August 14, 15, 21, 24.—*Boyne City.*

Frost, August 15.—*Parkville.*

SEPTEMBER.

Sept. 2, ground white with frost this morning, but vegetation does not seem to be much damaged.—*Ann Arbor.*

Frosts, Sept. 1, 5.—*Swartz Creek.*

Frosts, Sept. 2, 17; very slight, only tenderest vegetation killed. Movements of migratory birds—no blackbirds or flycatchers were seen after Sept. 5; last flock of robins seen Sept. 15; yellow birds last seen Sept. 23; bluebirds, field and tree sparrows, meadow larks, and highholes (Picus auratus) are still to be seen. The last named is occasionally seen in the winter.

September was a warm, pleasant month with a considerable rainfall in its first half and none in the latter. The maximum temperature was higher than that of August. The absence of severe frost has been very favorable to the corn crop, which has nearly all matured. The sowing of wheat was delayed by the rains of the fore part of the month, but at its close the top seems large enough to insure its wintering well. Potatoes are rotting.—*Thornville.*

Light frost Sept. 2.—*Port Huron.*

Light frosts Sept. 6, 23.—*Grand Haven.*

Frosts Sept. 2, 6, 11.—*Alpena.*

Frost Sept. 23.—*Mackinaw City.*

Frosts Sept. 5, 6, 7, 16, 22, 23. Monthly temperature of Little Bay de Noquette: Surface, 57.8°; bottom, 56.6°.—*Escanaba.*

Frosts Sept. 2, 3, 4, 7, 10, 16, 23. First ice on Sept. 23.—*Manistique.*

Light frosts Sept. 10, 25. Killing frost Sept. 23.—*Marquette.*

First frost of the season Sept. 6. Heavy frost Sept. 23.—*Pentwater.*

Frosts Sept. 2, 6, 23.—*Lansing.*

Frost Sept. 2. Many spring birds appeared latter part of this month.—*Birmingham.*

OCTOBER.

Frosts Oct. 7, 9, 10, 18, 21, 23, 24, 25, 31. Oct. 31, temperature has been below freezing point for the last 24 hours. Soil frozen this morning to depth of one inch. First cold snap of the season.—*Ann Arbor.*

Frosts Oct. 6, 8, 9, 10, 17, 21, 23, 24, 25, 31.—*Swartz Creek.*

October was a month of about normal conditions for the season; as it closes much farm work remains to be done. Potatoes are generally dug, but the corn husking has hardly begun, nor are the apples picked. If there is time to save the corn it will prove a fair crop. Potatoes have rotted badly, and what are sound are very scabby. Apples are not over one-third of a crop, but good in quality. The growing wheat looks well. Movements of migratory birds: Robins and bluebirds seen all the month, meadow larks and killdeer seen till Oct. 17, blackbirds (a solitary one) seen Oct. 27, wild geese passed over Oct. 27, 28. Freezing began Oct. 6; afterwards the mornings without ice were Oct. 12, 13, 14, 19, 20, 26, 27, 28, 29.—*Thornville.*

Frosts (first killing) Oct. 7, 9, 18, 21, 24, 25, 31.—*Port Huron.*

First frost to do harm Oct. 23: tomato vines hurt but very little.—*Port Austin.*

Light frosts, Oct. 10, 15. Killing frosts, Oct. 9, 18, 23, 24, 30, 31.—*Grand Haven.*

Frosts, Oct. 4, 5, 7, 9, 15, 18, 21 to 25, 30, 31.—*Alpena.*

Frosts, Oct. 9, 15, 18, 23, 30, 31.—*Mackinaw City.*

Frost, Oct. 4 to 9, 16, 18 to 24, 27 to 31. Ice, Oct. 5, 6, 18, 21 to 24, 28 to 31. Monthly temperature of Little Bay de Noquette, surface, 52.5°; bottom, 51.6°.—*Escanaba.*

Geese flying south, Oct. 5. Ice first formed on ground, Oct. 21. Ground first frozen, Oct. 23. Frosts, Oct. 5, 9, 18, 19, 22 to 24, 27 to 30.—*Manistique.*

Light frost, Oct. 23. Heavy frosts, Oct. 24, 31.—*Marquette.*

Frosts, Oct. 7 to 10, 23 to 25, 31.—*East Saginaw.*

Heavy frosts, Oct. 8, 9, 10. Ice formed one-fourth inch thick, Oct. 20 to 23, inclusive.—*Hudson.*

Heavy frost, Oct. 7. Ground frozen two inches, first considerable freeze of the season, Oct. 31.—*Birmingham.*

*Heavy frosts, Oct. 7, 9, 10, 18, 23, 24, 31. Light frosts, Oct. 11, 16. Ice formed, Oct. 23, 24. First snow of the season, Oct. 31.—*Lansing.*

NOVEMBER.

First snow-fall of the season, Nov. 1. Heavy white frost, Nov. 11.—*Ann Arbor.*

Frosts, Nov. 10, 17, 20, 21, 22, 28.—*Swartz Creek.*

Light frost; ice formed one-fourth inch thick, Nov. 21.—*Ionia.*

Winter set in, Nov. 13.—*Parkville.*

Large flock of robins seen, Nov. 1. Wild geese passed over, Nov. 7. A cloudy, wet month, without a single clear or fair day. Some fall work remains to be done, corn to be husked and stalks drawn, and now and then clover seed not saved.—*Thornville.*

Frosts, Nov. 10, 17.—*Port Huron.*

Frosts, Nov. 11, 17, 24, 25.—*Grand Haven.*

Frosts, Nov. 11, 15, 17, 19, 20, 21, 25, 27, 28. Melting snow on ground, Nov. 2, 3, 4, 13, 14, 21, 22, 23, 26, 27.—*Alpena.*

Heavy frost, Nov. 10.—*Mackinaw City.*

Frosts, Nov. 2 to 6, 8 to 10, 12 to Ice, Nov. 3, 5, 9, 10, 13 to 16, 19 to 29. Monthly temperature of Little Bay de Noquette, surface, 42.6°; bottom, 41.5°.—*Escanaba.*

Frosts, Nov. 10, 14, 17, 19, 23, 24, 25. Melting snow on ground, Nov. 1, 2, 3, 4, 5, 16, 17, 21, 26.—*Manistique.*

Light frost, Nov. 9.—*Marquette.*

Melting snow on ground, Nov. 1.—*Pentwater.*

Frosts, Nov. 11, 17, 20, 21, 22, 25, 28. Ground frozen, Nov. 14, 15, 17, 21, 22, 24, 25. Ice formed, Nov. 3, 17. Melting snow on ground, Nov. 1, 2, 14.—*Lansing.*

Up to Nov. 30 there has been little freezing. Wheat and grass continue to grow. Cattle have not yet been foddered.—*Birmingham.*

DECEMBER.

Frosts Dec. 2, 3, 26, 27.—*Swartz Creek.*

Frost Dec. 2.—*Ionia.*

A cloudy month with fair average temperature. Little or no snow on the ground at close.—*Thornville.*

Frosts Dec. 20, 21, 26. Black River frozen Dec. 17. Navigation on the lakes closed Dec. 17.—*Port Huron.*

First appearance of ice in the lake Dec. 6.—*Port Austin.*

Killing frosts Dec. 2, 26. Wild geese flying south Dec. 29; river frozen over Dec. 7; river opened Dec. 9. Thaw Dec. 15, 16.—*Grand Haven.*

Frosts Dec. 2, 8, 20, 21, 24, 25, 26. Melting snow on ground Dec. 3, 4, 9, 10, 13, 18, 19, 24, 28, 29. River frozen over Dec. 6; opened again Dec. 22.—*Alpena.*

Melting snow on ground from Dec. 21 to 30, inclusive.—*Mackinaw City.*

Frosts Dec. 1 to 31, inclusive. Thaws Dec. 18, 21, 22. Ice Dec. 1 to 21, 23 to 27, 29, 31. Monthly temperature of Little Bay de Noquette: Surface, 37.2°; bottom, 36.5°.—*Escanaba.*

Manistique River frozen over Dec. 5. Last line steamer out, "Van Ralte," for Harbor Springs, Dec. 10. Last boat in harbor, tug "Owen," from Escanaba, Dec. 25. Melting snow on ground Dec. 18 to 31. No frost in ground Dec. 31.—*Manistique.*

Light frost Dec. 21, 22.—*Marquette.*

Melting snow on ground Dec. 18, 20 to 23.—*Pentwater.*

Frosts Dec. 1, 20, 26. Ground frozen Dec. 24. First sleighing Dec. 5. Grand River frozen over during night of Dec. 5 to 6. Snow all gone except in shaded spots Dec. 23.—*Lansing.*

Dec. 5, winter sets in.—*Ann Arbor.*

Dec. 31, frost is out of the ground, and wheat and grass are growing. Stock are getting much of their living from the fields.—*Birmingham.*

MEASUREMENTS AND TEMPERATURE OF GROUND WATER.

In a paper entitled "Typhoid Fever and Low Water in Wells," on pages 89–114 of the report of this board for 1884, it is shown that for the years 1878–82 there was a relation between the sickness and deaths from typhoid fever in Michigan and the depth of water in wells. In the month of October, when the water in wells reached the lowest point in the year, there were the most deaths and sickness from typhoid fever; and following the month of April, when the water in wells was highest, there were the least deaths and sickness from typhoid fever. When this comparison is made in a diagram, it is found that, "beginning with June in each year, the curve representing sickness from typhoid fever follows more or less closely the curve representing the average depth of earth above the ground-water."

Typhoid fever being one of the most important causes of deaths in Michigan, it is of very great importance that further evidence be collected on this important subject.

The measurement, for each month in 1885, of the depth of wells, at eleven places in Michigan, are shown in Exhibit 4; also the depth of earth above water in wells and temperature of water in wells. It is hoped these measurements and observations may continue, and permit a more extended comparison of the depth of water in wells with the sickness from typhoid fever, and with sickness and death from other diseases.

Comments on the subject of a new instrument shelter at Lansing are printed on page 21, Report for 1885. Exhibits A, B, C, and D of this Report, relate to that subject, and may be studied in connection with what is said on page 21, Report for 1885. The fact of the change of place of observation in 1884 may need to be taken into account by whoever studies the meteorology at Lansing through a long series of years.

EXHIBIT 4.—*Depth of Wells; Depth of Ground above Water in Well; Temperature of Water in Well, and Day of observation of such temperature, in each month of the Year 1885, as reported by Meteorological Observers for the State Board of Health, and for the United States Signal Service.*

Stations in Michigan.	January.			February.			March.			April.			May.			June.		
	Depth of Well,—Ft., In.	Depth of Ground above Water in Well,—Ft., In.	Temp. of Water in Well,—Deg. F.	Depth of Well,—Ft., In.	Depth of Ground above Water in Well,—Ft., In.	Temp. of Water in Well,—Deg. F.	Depth of Well,—Ft., In.	Depth of Ground above Water in Well,—Ft., In.	Temp. of Water in Well,—Deg. F.	Depth of Well,—Ft., In.	Depth of Ground above Water in Well,—Ft., In.	Temp. of Water in Well,—Deg. F.	Depth of Well,—Ft., In.	Depth of Ground above Water in Well,—Ft., In.	Temp. o. Water in Well,—Deg. F.	Depth of Well,—Ft., In.	Depth of Ground above Water in Well,—Ft., In.	Temp. of Water in Well,—Deg. F.
Manistique										14 2	10	39.2 [19]	14 2	10	43 [23]	14 2	10	47 [28]
Thornville	20	17 6	[16]	20	17 6	36 [15]	20	16 8	36 [16]	20	16	45 [15]				20	16 6	48 [15]
Lansing	26 11½	23 11½	49 [15]	26 11½	24 1¾	47 [14]	26 11½	24 4¾	43 [16]	26 11½	23 3½	42 [16]	26 11½	23 5	46 [15]	26 11½	23 3	48 [15]
	15	12 3	43 [7]	15	12 10	42 [15]	15	13 3	42 [1]	15	9 8	36 [5]	15	10 6	39 [3]	15	10 5	45 [7]
		12 3	42 [14]		12 11	42 [22]		12 7	42 [8]		10 3	38 [12]		8 7	42 [10]		10 11	47 [14]
Ann Arbor		12 5	43 [21]		13 3	42 [28]		11 11	41 [15]		10 5	38 [19]		9 10	42 [17]		11 2	48 [21]
								12 2	40 [22]		9	38 [26]		11 3	43 [24]		11 6	48 [28]
								11 6	39 [29]					10 10	44 [31]			
Battle Creek	80	63	50 [30]	80	58 11½	48 [26]	80	59 1¾	49 [27]	80	58 6	49 [14]	80	57 11	49 [15]	80	58 1	51 [21]
Kalamazoo (Asylum)	24	7 6	49 [30]	24	8	49 [16]	24	17	48 [17]	24	14	50 [16]	24	13	50 [14]	24	15	50 [16]
Tecumseh	40	37	50	40	38 6	50	37	34 6	50 [24]	37	34 6	50 [20]	37	34	50 [21]	37	34	50 [12]
Birmingham							25	19	40 [20]									
Hudson																		
East Saginaw																		
Hillsdale	27	21 5	50 [15]							27	19 7	50 [16]	27	18 2	50 [15]	27	24 5	50 [18]

NOTE.—The small figures above and at the right of the numbers denoting the degrees of temperature, state the day of the month on which the observation was made.

EXHIBIT 4.—*Continued.*

Stations in Michigan.	July.			August.			September.			October.			November.			December.		
	Depth of Well.—Ft., In.	Depth of Ground above Water in Well.—Ft., In.	Temp. of Water in Well.—Deg. F.	Depth of Well.—Ft., In.	Depth of Ground above Water in Well.—Ft., In.	Temp. of Water in Well.—Deg. F.	Depth of Well.—Ft., In.	Depth of Ground above Water in Well.—Ft., In.	Temp. of Water in Well.—Deg. F.	Depth of Well.—Ft., In.	Depth of Ground above Water in Well.—Ft., In.	Temp. of Water in Well.—Deg. F.	Depth of Well.—Ft., In.	Depth of Ground above Water in Well.—Ft., In.	Temp. of Water in Well.—Deg. F.	Depth of Well.—Ft., In	Depth of Ground above Water in Well.—Ft., In.	Temp. of Water in Well.—Deg. F.
Manistique	14 2	10	47 [15]	14 2	10	46 [16]							14 2	10	43 [16]			
Thornville	20	16 10	48 [15]	20	16 8	48 [16]	20	16 3	49 [15]	20	16 5	46 [15]	20	16 8	46 [17]	20	16 8	41 [15]
Lansing	26 11½	23 5¾	47 [15]	26 11½	23 6⅝	48½ [15]	26 11½	23 5⅝	50 [15]	26 11½	23 8⅜	50 [16]	26 11½	23 5⅜	51 [16]	26 11½	23 4¾	45 [16]
	15	12 8	49 [5]	15	12 8	54 [2]							15 2⅖	13 1¼	48.6 [16]	15 2½	11 3½	42 [16]
		12 7	50 [12]		12 9	54 [9]												
Ann Arbor		12 7	52 [26]		12 11	54 [11]												
Battle Creek	80	58 1	50 [17]	80	58	49 [26]	80		49 [4]	90	72 8	51 [14]	70	60	51 [22]	70	60	51 [17]
Kalamazoo (Asylum)	24	16	50 [14]	24	18	51 [20]	24	22	52 [24]				24	17	51 [16]	24	21	50 [31]
Tecumseh	37	34 6	50 [19]			50			50			50	37	34 6	49 [20]			50
Birmingham																		
Hudson										17	7	51	17	6	46	17	6 11	42 [20]
East Saginaw							14	5	56.5 [20]				14	1 11	50 [16]	14	2 2	46 [17]
Hillsdale	27	19 8	51 [15]	27	18 3	52 [15]	27	18 8	54 [15]	27	19 8	54 [15]	27	19 2	52 [14]	27	18 4	52 [15]

NOTE.—The small figures above and at the right of the numbers denoting the degrees of temperature, state the day of the month on which the observation was made.

EXHIBIT A.—*Comparison of the Average Temperature from July, 1884, to June, 1885, by Observations made at the window of the Office of the State Board of Health, with the Average obtained by Observations made at the same time at the new shelter for Meteorological Instruments placed in the Yard, S. W. side of Capitol, showing the effect of the Building on the Instruments by Radiation, Reflection and Protection.*

Months, 1884-85.	Average Temperature,—Degrees Fahr.												
		1884.						1885.					
	Av. Month.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	June.
Av. at Office window	45.26	69.77	68.58	67.99	53.47	36.51	26.01	16.64	12.08	22.82	45.46	57.30	66.49
Av. at Shelter for Instruments	43.90	68.76	67.23	65.87	51.84	35 12	25.11	15.85	10.49	21.57	43.97	55.71	65.26
At Office Window **Higher** than at Shelter for Instruments	1.36	1.01	1.35	2.12	1.63	1.39	0.90	0.79	1.59	1.25	1.49	1.59	1.23

EXHIBIT B.—*Comparisons of the Extremes and the Range of Temperature during each of the 12 Months, July, 1884, to June, 1885, with the Average of the Extremes and of the Range, by Observations made at the new shelter for Meteorological Instruments in the Yard, S. W. side of Capitol, with those obtained by Observations made at the window of the Office of the State Board of Health, at the same Hours, showing the effect of the Building on the Instruments by Radiation and Protection. (Observations made with Registering Thermometers.)*

Months, 1884-85.	Extremes and Ranges of Temperature.—Degrees F.								
	Observations at Shelter for Instruments.			Observations at Office Window.			Higher (+) or Lower (-) at Shelter for Instruments than at Office Window.		
	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.
12 Months	91	-22	113	93	-23	116	-2	-1	-3
Av. 12 Months	71	15	56	73	16	57	-2	-2	0
July	89	45	44	88	50	38	+1	-5	+6
August	91	39	52	93	42	51	-2	-3	+1
September	91	38	53	93	43	50	-2	-5	+3
October	82	25	57	85	27	58	-3	-2	-1
November	60	9	51	63	9	54	-3	0	-3
December	55	-22	77	55	-18	73	0	-4	+4
January	45	-16	61	45	-15	60	0	-1	+1
February	45	-22	67	46	-23	69	-1	+1	-2
March	46	-10	56	49	-10	59	-3	0	-3
April	80	23	57	82	22	60	-2	+1	-3
May	80	29	51	84	29	55	-4	0	-4
June	85	41	44	89	41	48	-4	0	-4

EXHIBIT C.—*Comparison of the Average Absolute Humidity for each of the twelve months, July, 1884, to June, 1885, by observations made at the window of the office of the State Board of Health, with the average obtained by observations made at the same time at the new Shelter for Meteorological Instruments placed in the yard, S. W. side of Capitol, showing the effect of the building on the instruments.*

Months, 1884-85.	Absolute Humidity—Grains of Vapor in a Cubic Foot of Air.												
	Av. 12 Months.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
Av. at Office window	3.24	5.38	5.30	5.30	3.81	2.21	1.76	1.14	1.01	1.25	2.72	3.92	5.13
Av. at Shelter for Instruments	3.30	5.48	5.52	5.45	3.86	2.23	1.85	1.18	1.05	1.26	2.65	3.85	5.19
At Shelter for Instruments **Greater** than at Office Window	.06	.10	.22	.15	.05	.02	.09	.04	.04	.01	......	......	.06
At Shelter for Instruments **Less** than at Office Window	......	......	......	......	......	......	......	......	......	......	.07	.07	......

EXHIBIT D.—*Comparison of the Average Relative Humidity for each of the twelve months, July, 1884, to June, 1885, by observations made at the window of the office of the State Board of Health, with the average obtained by observations made at the same time at the new Shelter for Meteorological Instruments placed in the yard, S. W. side of Capitol, showing the effect of the building on the instruments.*

Months, 1884-85.	Per Cent. of Saturation—Relative Humidity.												
	Av. 12 Months.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
Av. at Office window	71	63	66	66	70	76	82	77	81	70	65	64	66
Av. at Shelter for Instruments	76	68	73	73	76	81	86	83	89	76	67	67	70
At Shelter for Instruments **Greater** than at Office Window	5	5	7	7	6	5	4	6	8	6	2	3	4

TEMPERATURE.

Compared with the average for the preceding 21 years at the Agricultural College the mean temperature for the months, January, February, March and August, was low. A comparison, by months, of temperature in 1885, with the averages for corresponding months in the preceding 21 years, 1864–84, at the Agricultural College, near Lansing, is given in Exhibit 6, page 25.

The average temperature, by months, for the 7 years, 1879–85, at Lansing, and a comparison of 1884, by months, with that average, are stated in Exhibit 7, page 25.

The average annual and monthly temperature at from 12 to 22 stations for a period of 9 years, 1877–85, is stated in Exhibit 5, page 24, in which is also given, by months, a comparison of 1885 with the average for 1884, and with the average for the 9 years, 1877–85. By Exhibit 5, page 24, which gives averages for groups of several stations in Michigan, it appears that in 1885 the mean temperature in February, March, April, May, June, August, September and October was lower than in those months in 1884. It also appears

that the months of February and March were much colder than the average temperature of the corresponding months for the 9 years, 1877–85, and November slightly warmer than the average temperature of the corresponding months for those years.

By Exhibit 10, page 31, it appears that, at the Agricultural College, the lowest temperature reached in January, February, March, and December, 1885, was considerably below the average lowest temperature for the preceding 12 years, and that in the month of February, 1885, the range of temperature was much greater than the average range of temperature for the corresponding month in the 12 preceding years, and also the highest and lowest temperatures for 1885 were below the average highest and lowest for those years. The highest and lowest temperatures at the Agricultural College in every month of the 13 years, 1873–85, and comparisons of months in 1885, with the average highest and lowest temperatures by months for the preceding 12 years, are stated in Exhibit 10, page 31.

The average temperature at each of 21 stations in Michigan, and the average for the 21 stations in 1885, and in each month of that year, are stated in Table I, page 26; 7 of the lines in this table are represented in Diagram I., page 27.

The average daily range of temperature at from 6 to 18 stations per year, by months, for a period of 7 years, 1879–85, and a comparison of 1885 with the monthly averages for that period and for 1884, are given in Exhibit 8, page 30. The highest and lowest temperatures in every month in 1885, at each of 18 stations, are stated in Table II., pages 28 and 29. The average daily range of temperature by months in 1885, at each of 18 stations, and the average for the 18 stations, are stated in Table III., page 33. The lines for 8 of these stations are represented in Diagram II., page 32. It will be noticed that the greatest average daily range occurred during the months of February, March, June and July.

EXHIBIT 5.—*Average temperature, by year and months, in 1885*, compared with annual and monthly averages for the nine years, 1877–1885. These averages are for groups of several stations in Michigan.*

Years, Etc.	Average Temperature.—Degrees Fahr.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 9 years—1877-85.	46.25	20.77	23.89	29.76	44.14	56.23	65.30	70.73	68.23	61.73	50.72	36.23	27.28
Av. 7 years—1879-85.	45.48	20.08	21.85	28.64	42.61	56.16	65.00	69.93	66.09	61.11	50.51	35.73	26.58
1884 (20 stations).....	44.72	15.14	20.94	28.78	42.00	54.38	67.04	66.70	66.10	64.72	51.56	34.53	24.77
1885 (21 stations).....	42.36	15.46	10.21	19.51	41.39	53.32	63.39	71.13	63.23	59.14	45.78	38.14	27.59
In 1885 **Higher** than Av. 9 years—1877-85	......	......	......	......	......	......	......	0.40	......	......	......	1.91	0.31
In 1885 **Lower** than Av. 9 years—1877-85	3.89	5.31	13.68	10.25	2.75	2.91	1.91	......	5.00	2.59	4.94	......	......

NOTE.—The stations represented in the lines for average temperature for the years 1877–85 in Exhibit 5, are the following: Thornville, Kalamazoo, Tecumseh, Detroit, for 1877-85; Mendon for 1877-82; Battle Creek for 1877-80, 1882, 1885; Nirvana for 1877-79 and for first four months of 1880; Reed City for the last eight months of 1880 and for 1881-85; Coldwater, Ypsilanti, Woodmere Cemetery (near Detroit) for 1877-79; Otisville for 1878-80, 1882; Niles for 1878, 1879, 1881; Marquette for 1879-84; Alpena, Grand Haven, Port Huron, Lansing for 1879-85; Washington for 1879-83; Benton Harbor for 1877-78; Agricultural College for 1877, 1881-85; Petoskey for 1878-79; Escanaba for 1880-85; Harrisville for 1881-82, 1885; Ann Arbor for 1881-5; Parkville for 1881-2; Traverse City and Marshall for 1882-5; Hillsdale for 1882-4; Winfield for 1881, 1883; Hudson and Mallory Lake for 1881; Ionia for 1883-5; Manistique, Mackinaw City and Swartz Creek for 1884-5; Port Austin for 1885.

* Beginning with the year 1885, allowance must be made for Lansing in Exhibit 5, because of a change in the location of the instruments. The amount of the variation by months is shown in Exhibit A, on page 22.

EXHIBIT 6.—*Comparison of the Average Temperature during the Year and during each Month of the Year, 1885, with the Annual and with the Monthly Averages for the Year 1884, and with the Averages for the 21 Years, 1864-84. Observations made by Prof. R. C. Kedzie, at the State Agricultural College, near Lansing, Michigan.*

Years, Etc.	Average Temperature.—Degrees Fahr.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 21 yrs, 1864-84	46.64	22.10	24.52	31.53	45.61	58.21	67.88	71.45	69.02	60.40	48.45	35.27	25.46
1884	45.66	15.46	23.43	29.89	43.66	56.90	68.92	67.95	66.91	65.06	50.91	34.11	24.71
1885	42.90	15.31	8.94	21.26	43.59	55.76	64.69	72.70	63.62	58.94	44.95	37.22	27.75
In 1885 **Higher** than Av. for 21 y'rs—1864-84	......	......	......	......	......	......	......	1.25	......	......	......	1.95	2.29
In 1885 **Lower** than Av. for 21 y'rs—1864-84	3.74	6.76	15.58	10.27	2.02	2.45	3.19	......	5.40	1.46	3.50	......	......
In 1885 **Higher** than in 1884	......	......	......	......	......	......	......	4.75	......	......	......	3.11	3.04
In 1885 **Lower** than in 1884	2.76	0.12	14.49	8.63	0.07	1.14	4.23	......	3.29	6.12	5.96	......	......

EXHIBIT 7.—*Average Temperature,* by Year and Months, for the 7 Years, 1879-85. Observations made at Office State Board of Health, State Capitol, Lansing, Michigan.*

Years, Etc.	Average Temperature.—Degrees Fahr.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 7 years, 1879-85	47.54	21.51	24.10	31.29	45.54	59.08	67.56	72.72	69.52	62.51	52.09	37.08	27.45
1884	47.43	16.48	23.89	32.26	45.30	58.20	70.69	69.77	68.58	67.99	53.47	36.51	26.01
1885	43.01	15.85	10.49	21.57	43.97	55.71	65.26	73.35	63.28	55.86	45.43	38.21	27.14
In 1885 **Higher** than Av. for 7 y'rs—1879-85	......	......	......	......	......	......	......	0.63	......	......	......	1.13	......
In 1885 **Lower** than Av. for 7 y'rs—1879-85	4.53	5.66	13.61	9.72	1.57	3.37	2.30	......	6.24	6.65	6.66	......	0.31
In 1885 **Higher** than in 1884	......	......	......	......	......	......	......	3.58	......	......	......	1.70	1.13
In 1885 **Lower** than in 1884	4.42	0.63	13.40	10.69	1.33	2.49	5.43	......	5.30	12.13	8.04	......	......

* Beginning with the year 1885, slight allowance should be made for Lansing in Exhibit 7 because of a change in the location of the instruments. The amount of the variation by months is shown in Exhibit A, on page 22.

TABLE I.—*Average Temperature in Degrees Fahr., for the Year, and for each Month of the Year 1885, at each of 21 Stations in Michigan, and also the Average for the 21 Stations. From Observations made Daily at 7 A. M., 2 P. M. and 9 P. M.,* by Observers† for the State Board of Health, and for the U. S. Signal Service.*

Stations in Michigan.† (Those of the U. S. Signal Service in italics.)	Division of the State.‡	Temperature in Degrees Fahr.													
		Year.		Months, ¶ 1885.											
		Norm. ‖	1885.	Jan.	Feb.	Mar	Apr.	May.	J'ne.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 21 stations..§	......	......	42.36	15.46	10.21	19.51	41.39	53.32	63.39	71.13	63.23	59.14	45.78	38.14	27.59
Marquette............	U. P.	......	‡‡	.....	.....	11.90	34.90	45.40	55.70	63.70	58.00	53.50	41.50	34.30	23.40
Manistique	U. P.	[2]39.33	38.28	9.23	7.49	13.44	35.83	49.29	57.01	64.91	60.79	56.11	43.35	36.12	25.84
Escanaba............	U. P.	[14]40.39	37.57	7.00	5.80	[a]14.10	35.10	47.60	59.40	67.60	59.60	55.20	42.00	34.60	22.80
Traverse City........	N. W.	[3]41.58	40.50	14.67	7.08	15.29	38.29	[a]49.64	62.79	69.46	62.15	58.77	44.47	36.72	26.67
Boyne City............	N.	......	§§	13.82	.....	12.53	38.79	51.41	62.54	68.81	[b]60.24	57.51	43.11	35.62	26.39
Mackinaw City.......	N.	[2]39.34	38.03	12.50	7.70	11.90	34.90	44.40	56.70	65.30	59.30	55.50	43.90	37.10	27.10
Alpena...............	N. E.	[13]41.22	37.83	12.40	7.60	13.00	34.70	46.50	58.30	64.70	59.10	55.40	42.50	35.50	24.30
Harrisville............	N. E.	......	41.01	14.08	10.69	18.06	37.79	50.22	61.23	68.58	63.03	58.43	45.46	37.73	26.81
Grand Haven.........	W.	[11]46.74	42.94	20.70	15.00	23.40	42.70	52.80	59.80	67.30	60.80	59.60	45.80	38.90	28.50
Muskegon..............	W.	......	‖‖	.....	.....	.....	.....	.....	.....	71.86	64.10	61.19	45.60	39.30	28.23
Reed City..............	W.	[8]44.20	40.24	[c]14.62	6.08	14.27	40.64	[b]53.40	64.42	[e]70.94	60.61	57.13	41.68	34.97	24.11
Port Austin...........	B. & E.	[2]42.92	41.69	[d]16.47	9.82	16.92	38.68	[a]50.79	62.00	68.35	[c]63.44	59.90	[h]46.16	39.20	28.49
Port Huron...........	B. & E.	[11]45.02	41.75	16.30	10.60	18.60	39.40	50.00	61.90	69.30	63.00	59.00	46.40	38.70	27.80
Thornville	B. & E.	[9]47.77	44.93	17.33	10.82	21.14	45.18	57.80	66.93	74.89	65.67	61.64	48.20	39.97	29.57
Agricultural College	C.	[22]46.47	42.90	15.34	8.94	21.26	43.59	55.76	64.69	72.70	63.62	58.94	44.95	37.22	27.75
Ionia	C.	[3]44.46	43.91	16.52	10.70	21.63	44.23	56.25	66.28	74.72	64.89	[b]60.41	46.42	38.10	26.82
Lansing**	C.	[7]47.54	43.01	15.85	10.49	21.57	43.97	55.71	65.26	73.35	63 28	55.86	45.43	38.21	27.14
Swartz Creek.........	C.	[2]44.08	42.67	15.06	8.20	20.01	43.22	55.20	64.50	73.00	63.55	58.56	45.10	37.82	27.80
Ann Arbor............	S. C.	[5]45.72	43.40	15.50	10.80	21.70	42.60	55.20	64.60	73.00	64.30	59.94	46.55	38.29	28.36
Battle Creek..........	S. C.	[3]47.91	46.72	18.69	14.27	25.70	47.48	58.78	67.64	75.91	66.81	63.16	[h]50.98	40.87	30.35
Kalamazoo	S. C.	[9]47.61	44.36	16.95	12.05	22.77	44.50	56.71	66.71	73.47	64.39	[b]60.68	[c]47.33	[e]38.65	28.12
Marshall...............	S. C.	[3]47.15	46.04	17.08	12.65	25.16	46.60	58.46	68.38	76.34	66.84	62.67	48.63	39.79	29.86
Tecumseh..............	S. C.	[9]47.33	44.79	[b]15.34	11.10	23.51	44.67	[d]58.33	[d]66.72	75.25	[a]66.02	[f]62.32	45.42	[g]40.43	28.33
Birmingham..........	S. E.	......	¶¶	.....	.....	21.09	42.52	[a]56.27	64.66	[a]72.17	64.01	[b]59.07	46.41	[b]38.34	28.74
Detroit...............	S. E.	[14]48.29	43.94	23.00	16.60	26.20	45.10	56.80	65.90	74.70	66.70	62.70	50.60	42.10	32.90

[a], [b], [c]. In the columns from January to December, inclusive, the letters [a], [b], [c], etc., stand directly above the numbers from which they refer to the notes below.

[a] For 30 days. [b] For 29 days. [c] For 28 days. [d] For 27 days. [e] For 26 days. [f] For 24 days. [g] For 23 days. [h] For 21 days.

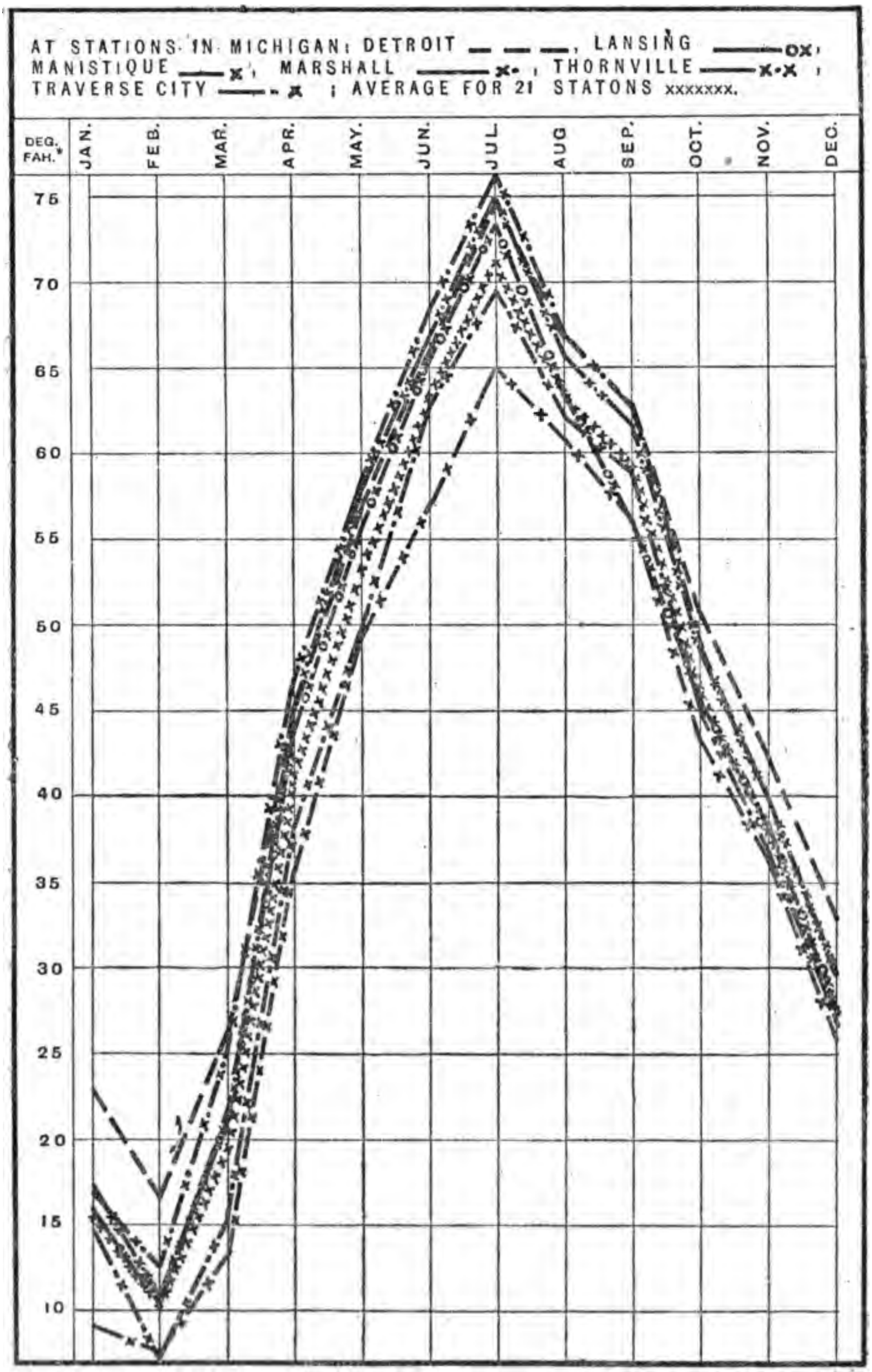
* At the U. S. Signal Service Stations for the year 1885, the observations were made at 7 A. M., 3 P. M., and 11 P. M., 75th meridian time, and one-third the sum of the three observations was taken as the daily average. The local time at these stations corresponding to 7 A. M., 3 P. M., and 11 P. M., 75th meridian time, is as follows: At Port Huron, 6:30 A. M., 2:30 P. M., and 10:30 P. M.; at Detroit, 6:28 A. M., 2:28 P. M., and 10:28 P. M.; at Alpena, 6:26 A. M., 2:26 P. M., and 10:26 P. M.; at Grand Haven, 6:15 A. M., 2:15 P. M., and 10:15 P. M.; at Mackinaw City, 6:22 A. M., 2:22 P. M., and 10:22 P. M.; at Escanaba, 6:12 A. M., 2:12 P. M., and 10:12 P. M.; at Marquette, 6:11 A. M., 2:11 P. M., and 10:11 P. M. At the other stations the observations were made at 7 A. M., 2 P. M., and 9 P. M., local time; and the daily averages were one-third the sum of these three observations.

† The names of observers, their places of observation, and the counties in which these places are situated, are stated in Exhibit 1, page 9.

‡ The names of divisions, and the counties in each are stated in Exhibit I., in a paper which follows on weekly reports of sickness.

§, ‖, ¶, **, ‡‡ See page 28.

DIAGRAM I.—AVERAGE TEMPERATURE, BY MOS., IN 1885.



*SCALE, 10° F. TO .92 IN. VERTICALLY.

H. B. T., DEL. DES. BY H. B. B.

TABLE II.—*Extremes of Temperature and Days of Month on which the Highest and for the Year 1885, at each of 18 Stations in Michigan.—As indicated by Daily Readings P. M., by Observers* for the State Board of Health, and for the U. S. Signal Service.*

Line Number.	Stations in Michigan.* (Those of the U. S. Signal Service in Italics.)	Year 1885.			January.		February		March.		April.		May.	
		Highest.	Lowest.	Range.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1	At 18 Stations..†	96	-36	132	53	-36	50	-33	55	-29	84	6	87	18
2	*Marquette*........§	....	....	.....	....	....	.....	.....	49 [31]	-15 [16]	76 [21]	10 [3]	81 [24]	27 [6,15]
3	Manistique......‡	92	-36	128	45 [5]	-36 [27]	42 [28]	-28 [9]	50 [31]	-29 [20]	65 [29]	6 [8]	78 [23]	24 [1,10]
4	*Escanaba*.........§	87	-26	113	35 [5]	-26 [28]	41 [28]	-25 [6]	48 [31]	-25 [21]	54 [29]	10 [3]	76 [25]	27 [2]
5	Traverse City...‡	93	-27	120	35 [5,8,12]	-25 [27]	44 [26]	-27 [5]	46 [31]	-24 [20]	82 [22]	11 [3,8]	82 [16]	20 [2]
6	Boyne City.......‡	....	....	.....	40 [5,29]	-36 [27]	.....	.....	49 [31]	-34 [20]	82 [21]	0 [1]	86 [23]	15 [3]
7	*Mackinaw City*..§	86	-33	119	40 [6]	-24 [28]	44 [28]	-33 [6]	41 [31]	-21 [20]	79 [22]	7 [4]	81 [16]	27 [3]
8	*Alpena*...........§	88	-23	111	37 [5]	-19 [27]	37 [27]	-23 [6]	43 [31]	-16 [17,21]	79 [21]	9 [9]	78 [16]	25 [3]
9	Harrisville.......‡	91	-30	121	40 [5,6]	-29 [26]	45 [28]	-30 [10]	45 [31]	-22 [16]	80 [21]	7 [8]	82 [26]	19 [2]
10	*Grand Haven*....§	86	-7	93	43 [8]	1 [27]	41 [4]	-7 [21]	45 [26]	-5 [21]	73 [21]	25 [14]	77 [17]	32 [15]
11	Reed City........‡	92	-33	125	40 [5]	-26 [26]	48 [28]	-33 [10]	48 [26]	-28 [20]	79 [22]	10 [3]	86 [24]	18 [2]
12	*Port Huron*.......§	90	-25	115	49 [6]	-15 [29]	43 [28]	-25 [11]	46 [31]	-14 [17]	80 [23]	16 [14]	81 [17]	26 [3]
13	Thornville........‡	94	-22	116	44 [6]	-13 [27]	45 [28]	-22 [6]	49 [26]	-11 [17]	84 [23]	21 [13,14]	85 [17]	28 [3]
14	Agr'l College....‡	90	-24	114	42 [6]	-22 [27,28]	45 [28]	-24 [10]	44 [26,31]	-13 [16]	81 [23]	17 [3]	85 [24]	26 [2]
15	Ionia.............‡	96	-20	116	44 [8]	-20 [26,27]	45 [28]	-20 [13]	49 [26]	-13 [16]	82 [23]	19 [3]	81 [23]	30 [10]
16	Lansing ‖........‡	91	-22	113	45 [6]	-16 [27]	45 [28]	-22 [10]	46 [26,31]	-10 [16,19,20]	80 [23]	23 [3,13]	80 [17,24]	29 [10]
17	Swartz Creek...‡	92	-27	119	45 [6]	-25 [28]	42 [28]	-27 [5]	45 [26]	-13 [16]	80 [23]	19 [13]	81 [17,24]	24 [2]
18	Ann Arbor ......¶	91	-23	114	44 [8]	-17 [29]	46 [28]	-23 [11]	47 [26,31]	-7 [20]	80 [23]	19 [4]	81 [17]	29 [3]
19	Marshall.........‡	95	-23	118	44 [5]	-16 [18]	46 [28]	-23 [10]	51 [27]	-8 [19]	81 [23]	20 [3,13]	84 [21]	28 [10]
20	Tecumseh........‡	96	-30	126	47 [6]	-20 [21,28]	47 [28]	-30 [12]	49 [4,31]	-8 [19,20]	82 [25]	18 [3,9]	87 [27]	25 [2]
21	Birmingham....‡	....	....	.....	....	....	.....	.....	46 [26]	-13 [20]	79 [23]	16 [13]	80 [17]	23 [2]
22	*Detroit*............§	90	-12	102	53 [8]	-7 [29]	50 [28]	-12 [10]	55 [26]	-2 [20]	77 [23]	20 [9]	80 [17,18]	25 [15]

NOTE.—The small figures above and at the right of numbers denoting the degrees of temperature, state the day or days of the month on which the highest or the lowest temperature occurred.

* The names of observers, etc., are stated in Exhibit 1, page 9.

† The line No. 1, and the three columns for the year 1885, relate only to the 18 stations from which observations were received for every month of the year. It does not include Marquette, Boyne City, or Birmingham.

Foot-notes from page 26.]

§ This line is an average for only the 21 stations from which statements nearly complete were received for every month of the year. It does not include Marquette, Boyne City, Muskegon and Birmingham.

‖ Numbers in this column state the average annual temperature for periods of years ending in each case with Dec. 31, 1885. The small figures above and at the right of numbers which state the temperature, denote the number of years included in the average.

¶ The computations of Av. Temp., as tabulated for months in 1885, were made at the following stations: Marquette, Escanaba, Mackinaw City, Grand Haven, Detroit, September excepted, Ann Arbor, September, October, November, December excepted. Alpena, Port Huron, Swartz Creek, October excepted, and Ionia, last eight months excepted. All other computations in Table I. were made at the office of the Secretary of State and the State Board of Health.

** Beginning with the year 1885, allowance must be made for Lansing in Table I., because of a change in location of instruments. The amount of the variation by months is shown in Exhibit A., page 22.

‡‡ The average for 10 months in 1885 is 42.23. §§ For 11 months, 42.80. ‖‖ For 6 months, 51.71. ¶¶ For 10 months, 49.33.

The lines for 6 representative stations in Table I. are graphically represented in Diagram I., page 27.

the Lowest Temperature occurred by Months of the Year 1885; also, Extremes and Range of Registering Thermometers, or by Observations made Daily at 7 A. M., 2 P. M. and 9

June.		July.		August.		September.		October.		November.		December.		Line Number.
Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	
93	32	96	39	90	35	88	25	81	13	68	19	55	-11	1
83 (18)	33 (8)	89 (16)	46 (2)	83 (12)	33 (23)	87 (21)	35 (28)	76 (2)	26 (30)	50 (7)	23 (13)	48 (23)	-8 (7)	2
80 (9, 28, 30)	32 (7)	92 (28)	41 (10)	85 (1)	37 (24)	80 (18, 29)	29 (22)	68 (1)	22 (29)	58 (17)	22 (13)	46 (2, 3)	-8 (6)	3
80 (15)	34 (8)	87 (28)	47 (14)	84 (18)	39 (25)	77 (22)	30 (23)	63 (2)	24 (31)	50 (7)	21 (14)	43 (23)	-10 (7)	4
93 (12)	38 (7, 8, 21)	92 (8, 20)	44 (10)	87 (12)	43 (14)	85 (21)	36 (22)	75 (10)	18 (30)	55 (7)	23 (13)	43 (22)	2 (6)	5
93 (12)	28 (30)	95 (20)	27 (10)	87 (12)	30 (21)	84 (29)	27 (22)	75 (11)	13 (30)	60 (7)	17 (26)	45 (22, 30)	10 (6)	6
82 (15)	37 (8)	86 (8)	44 (2)	76 (1)	44 (25)	80 (26)	38 (23)	63 (15)	21 (30)	60 (7)	27 (27)	46 (23)	2 (6)	7
87 (12)	37 (8)	88 (8)	44 (11)	81 (13)	42 (25)	88 (26)	35 (11)	63 (2)	20 (31)	61 (7)	22 (27, 28)	46 (23)	-5 (7)	8
91 (26, 27)	36 (7)	91 (8, 28)	41 (10)	82 (9, 18, 21)	40 (26)	84 (26)	35 (1)	67 (2)	20 (30)	62 (7)	20 (27)	48 (23)	-11 (6)	9
82 (14)	39 (10)	86 (22)	46 (1)	86 (1)	44 (27)	80 (29)	39 (23)	69 (11)	28 (30)	64 (11)	25 (24)	48 (2)	2 (6)	10
89 (14)	33 (1, 8)	92 (8)	39 (1)	85 (12)	35 (14)	83 (27)	25 (15)	74 (1)	13 (30)	57 (11)	19 (27)	44 (22)	-3	11
87 (7)	40 (8)	90 (20)	52 (2)	82 (18)	45 (15)	86 (26)	39 (2)	71 (2)	25 (31)	66 (7)	27 (28)	49 (9, 23)	-3 (7)	12
86 (7, 12, 14)	43 (2, 22)	94 (20)	54 (2)	86 (9)	44 (27)	85 (26)	40 (11)	76 (1)	24 (31)	68 (7)	25 (28)	49 (23)	-2 (7)	13
86 (14, 27)	40 (8, 21)	90 (28)	47 (1, 13)	84 (9)	42 (14, 25)	80 (6)	35 (22)	72 (2)	17 (30)	62 (1, 12)	21 (21, 22)	48 (30)	-7 (6)	14
88 (26, 27)	36 (10, 28)	96 (30)	43 (1, 14)	86 (1)	40 (15)	85 (26)	33 (6)	73 (1, 2)	21 (30)	63 (12)	24 (26)	48 (22)	-4 (6, 7)	15
85 (14)	41 (21)	91 (20, 28, 29)	47 (13)	83 (9)	41 (14, 31)	82 (26)	34 (22, 23)	73 (2)	18 (30, 31)	64 (7)	21 (21, 22)	48 (22, 23)	-6 (6)	16
87 (14)	39 (21)	92 (20)	44 (1)	84 (9)	41 (14)	82 (26)	36 (5, 22)	77 (2)	13 (30, 31)	66 (7)	23 (21, 27)	50 (5)	-6 (7)	17
87 (14)	43 (9)	91 (20)	51 (2)	86 (9)	47 (27)	80 (26)	37 (23)	73 (1, 2)	22 (31)	66 (7)	25 (22, 26)	49 (23)	-4 (7)	18
90 (14)	41 (8)	95 (31)	48 (2)	85 (12)	42 (19)	84 (27)	38 (5)	75 (2)	20 (29)	63 (6, 7)	22 (27)	48 (22)	-8 (6)	19
90 (14)	42 (8, 21, 29)	96 (20)	52 (2)	90 (9)	43 (27)	85 (26)	35 (22)	81 (2)	16 (30)	66 (7)	25 (21)	51 (23)	-4 (6, 7)	20
89 (14)	41 (8)	90 (28)	51 (2)	84 (9, 12)	42 (16, 26)	79 (26)	37 (1)	72 (1, 2)	21 (30)	61 (6)	22 (1)	48 (28)	-7 (7)	21
87 (15, 26)	44 (9)	90 (8)	54 (2)	86 (9)	48 (27)	81 (26)	41 (23)	72 (1)	28 (31)	67 (7)	29 (22)	55 (9)	1 (7)	22

‡ For stations marked thus ‡, the daily readings of registering thermometers were recorded at 7 A. M. for the preceding calendar day.

§ At the stations of the U. S. Signal Service the observations with registering thermometers were read and recorded at 11 P. M.

¶ At Ann Arbor the registering thermometers were read and recorded at 9 P. M.

‖ Beginning with the year 1885 allowance must be made for Lansing in Table II, because of a change in the location of the instruments. The amount of the variation by months is shown in Exhibit B, on page 22.

EXHIBIT 8.—*Average Daily Range of Temperature, by Year and Months in 1885, compared with Annual and Monthly Averages for the 7 Years, 1879–85. These Averages are for Groups of several Stations in Michigan.**

Years, Etc.	Average Daily Range of Temperature.—Degrees Fahr.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 7 y'rs, 1879-85*	18.25	16.72	18.35	18.32	19.31	20.69	20.42	20.15	19.85	19.87	17.45	14.63	13.29
1884—(18 stations*)...	19.01	17.72	17.79	19.88	19.22	19.50	21.90	20.83	21.27	20.87	18.69	16.37	14.09
1885—(18 stations*)...	18.78	17.03	22.94	22.22	18.25	19.72	22.73	22.09	18.45	20.42	16.81	11.53	13.19
In 1885 **Greater** than Av. 7 y'rs, 1879-85	0.53	0.31	4.59	3.90	......	......	2.31	1.94	......	0.55	......	......	......
In 1885 **Less** than Av. 7 years, 1879-85	......	......	......	......	1.06	0.97	......	......	1.40	......	0.64	3.10	0.10
In 1885 **Greater** than in 1884	......	......	5.15	2.34	......	0.22	0.83	1.26	......	......	......	......	......
In 1885 **Less** than in 1884	0.23	0.69	......	......	0.97	......	......	......	2.82	0.45	1.88	4.84	0.90

* Marquette for 1879–84; Grand Haven, Lansing, and Detroit for 1879–85; Otisville for 1879–80, 1882; Battle Creek for 1879–80; Escanaba, Alpena, Port Huron, and Thornville for 1880–85; Kalamazoo for 1880–3; Adrian for 1880; Agricultural College for 1881–5; Traverse City and Marshall for 1882–5; Harrisville for 1882, 1885; Reed City for 1882, 1884–5; Ann Arbor for 1882–3, 1885; Washington for 1882–3; Winfield for 1883; Tecumseh for 1883–5; Manistique, Mackinaw City, Ionia, Swartz Creek for 1884–5; Hillsdale for 1884.

EXHIBIT 9.—*Comparisons of the Average Daily Range of Temperature for the Year and for each Month of the Year, 1885, with Averages for the 11 Years, 1874–84, and for the Year 1884. Observations made with Registering Thermometers by Prof. R. C. Kedzie, at the State Agricultural College, near Lansing, Michigan.*

Years, Etc.	Average Daily Range of Temperature.—Degrees Fahr.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 11 y'rs, 1874-84*	21.18	16.92	18.99	19.32	22.94	25.17	23.55	24.99	26.17	24.46	20.57	16.27	14.78
1884	20.30	16.84	16.17	19.35	21.33	22.45	24.60	24.77	24.39	22.73	20.11	16.67	14.20
1885	19.36	17.40	24.39	20.94	18.97	21.00	23.03	22.52	19.58	21.13	17.81	12.43	13.06
In 1885 **Greater** than Av. for 11 y'rs, 1874-84	......	0.48	5.40	1.62	......	......	......	......	......	......	......	......	......
In 1885 **Less** than Av. for 11 y'rs, 1874-84	1.82	......	......	......	3.97	4.17	0.52	2.47	6.59	3.33	2.76	3.84	1.72
In 1885 **Greater** than in 1884	......	0.56	8.22	1.59	......	......	......	......	......	......	......	......	......
In 1885 **Less** than in 1884	0.94	......	......	......	2.36	1.45	1.57	2.25	4.81	1.60	2.30	4.24	1.14

* For the years 1874–6, 1878, 1879 (except Nov. and Dec.), and 1880, the computations were made from the report of observations published in the Reports of the State Board of Agriculture for those years. For 1877, 1881 (except Jan.), 1882–85, the computations were made from registers or copies of registers supplied by Dr. Kedzie.

EXHIBIT 10.—*Comparisons of the Extremes and the Range of Temperature (Degrees Fahr.) during the Year, and during each month of the Year 1885, with the Average of the Extremes, and of the Range, for the Twelve Years, 1873–84; also, Statement of the Extremes and of the Range for each of the Twelve Years, 1873–84. Observations made with Registering Thermometers (except for the first two months of 1873, and for those two months with an ordinary Thermometer, at 7 A. M., 2 P. M. and 9 P. M.) Daily, by Prof. R. C. Kedzie, at the State Agricultural College, near Lansing, Mich. For Nov. and Dec., 1879, the observations were made by Harry B. Turner, at the Office of the State Board of Health, Lansing.*

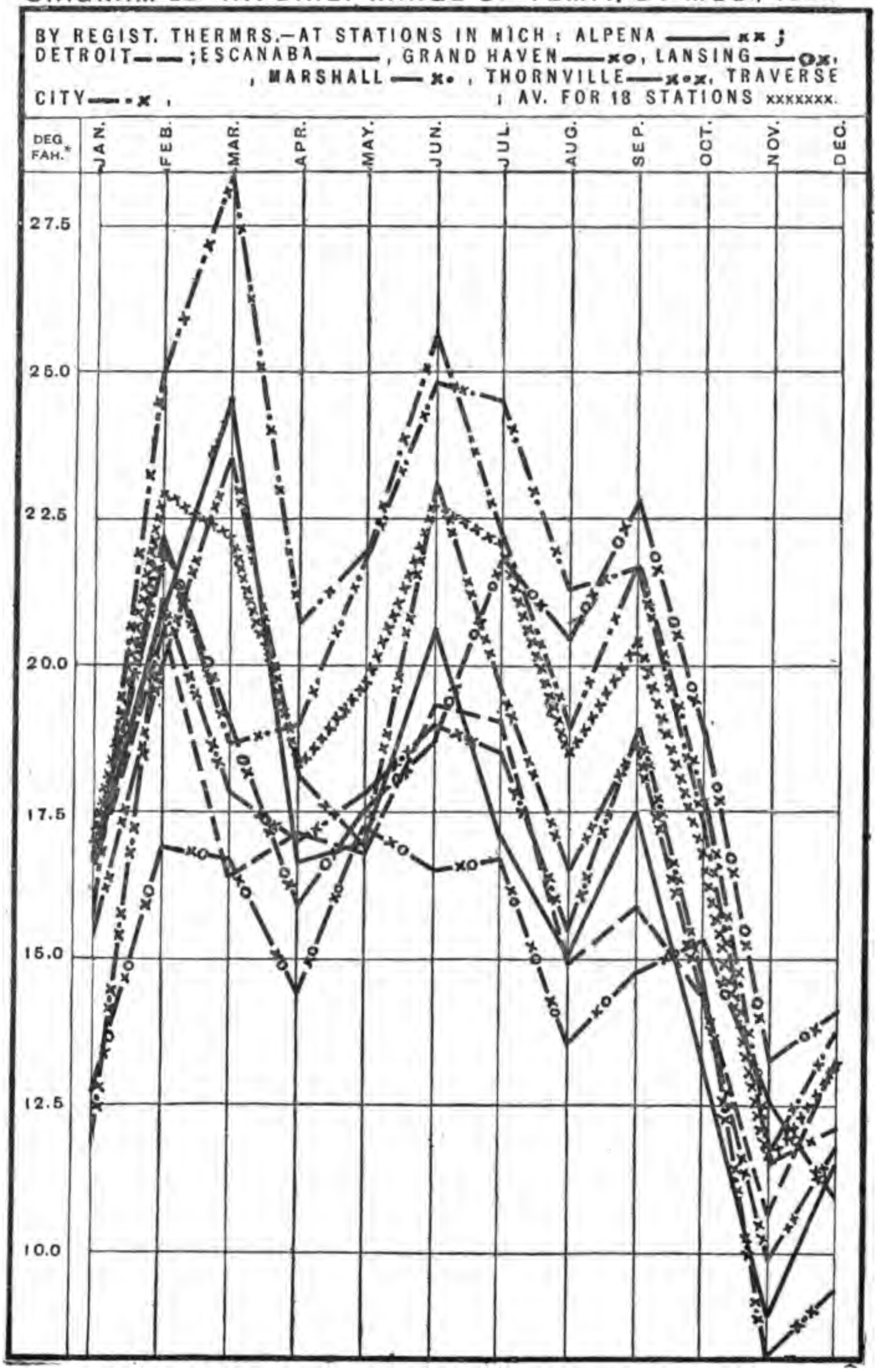
Extremes and Ranges of Temperature.—Degrees F.

Year and Months.	1873.			1874.			1875.			1876.			1877.			1878.			1879.		
	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.
Year	94	-30	124	101	-7	108	94	-33	127	96	-19	115	93	-14	107	98	-7	105	97	-18	115
Av. Month	74	15	59	77	15	62	75	10	64	74	19	56	74	20	54	73	22	51	76	15	61
January	43	-30	73	59	-7	66	35	-13	48	65	6	59	52	-9	61	48	-4	52	44	-18	62
February	49	-13	62	48	-1	49	42	-33	75	59	-1	60	56	10	46	55	-7	62	41	-6	47
March	57	-12	69	67	8	59	75	-11	86	60	0	60	51	-14	65	72	18	54	66	4	62
April	82	24	58	68	3	65	80	0	80	74	16	58	81	18	63	75	29	46	81	12	69
May	84	27	57	96	21	75	89	24	65	89	31	58	90	26	64	77	29	48	91	25	66
June	94	42	52	95	34	61	89	33	56	95	42	53	89	40	49	94	39	55	95	33	62
July	92	44	48	98	43	55	92	44	48	96	46	50	91	43	48	98	47	51	97	47	50
August	94	44	50	101	41	60	93	35	58	96	36	60	93	43	50	93	42	51	96	34	62
September	89	26	63	95	30	65	94	26	68	80	36	44	85	38	47	92	31	61	85	27	58
October	79	16	63	76	16	60	77	18	59	75	19	56	87	26	61	82	21	61	87	15	72
November	56	1	55	70	3	67	60	2	58	62	12	50	55	4	51	52	15	37	75	13	62
December	64	10	54	50	-6	56	70	-1	71	41	-19	60	58	13	45	36	-2	38	58	-3	61

Year and Months.	1880.			1881.			1882.			1883.			1884.			Av. for 12 years, 1873–84.			1885.*			1885 Higher (+), or lower (-), than Av. 12 yrs, 1873–84.		
	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.
Year	94	-17	111	100	-17	117	89	-10	99	91	-20	111	90	-25	115	95	-18	113	90	-24	114	-5	-6	+1
Av. Month	74	20	54	73	22	52	72	23	49	71	14	57	71	14	58	74	17	57	68	15	53	-6	-2	-4
January	62	9	53	37	-9	46	50	-2	52	41	-19	60	44	-22	66	48	-10	58	42	-22	64	-6	-12	+6
February	59	-2	61	48	-17	65	57	12	45	50	-20	70	52	-18	70	51	-8	59	45	-24	69	-6	-16	+10
March	55	6	49	50	9	41	66	16	50	52	-8	60	57	-13	70	61	0	61	44	-13	57	-17	-13	-4
April	76	20	56	83	9	74	73	21	52	83	14	69	74	21	53	78	16	62	81	17	64	+3	+1	+2
May	87	40	47	89	33	56	79	28	51	80	31	49	80	28	52	86	29	57	85	26	59	+1	-3	+2
June	92	41	51	86	40	46	87	44	43	87	42	45	89	43	46	91	39	52	86	40	46	-5	+1	-6
July	94	50	44	95	52	43	89	47	42	90	45	45	89	44	45	93	46	47	90	47	43	-3	+1	-4
August	88	43	45	100	46	54	89	49	40	91	32	59	90	36	54	94	40	54	84	42	42	-10	+2	-12
September	88	30	58	97	43	54	85	32	53	86	28	58	89	36	53	89	32	57	80	35	45	-9	+3	-12
October	76	24	52	75	30	45	77	24	53	77	22	55	81	22	59	79	21	58	72	17	55	+7	-4	-3
November	62	-4	66	64	12	52	70	14	56	63	7	56	59	10	49	62	7	55	62	21	41	=	+14	-14
December	47	-17	64	56	12	44	40	-10	50	55	-2	57	53	-25	78	52	-4	56	48	-7	55	-4	-3	-1

* For the thirteen years, 1873–85, the highest temperature was 101°, August 11, 1874; the lowest was -33°, February 8, 1875, and the range was 134°, F.

DIAGRAM II. AV. DAILY RANGE OF TEMP., BY MOS., 1885.



*SCALE, 5° F. RANGE TO 1.58 IN. VERTICALLY.

H. B. T. DEL. DES. BY H. B. B.

TABLE III.—*Average Daily Range of Temperature, by Registering Thermometers, during the Year and during each Month of the Year 1885, at each of 18 Stations in Michigan, and Average for the 18 Stations.*

Stations in Michigan.* (Those of the U. S. Signal Service in Italics.)	Divisions of the State.†	Norm. ‡	Average Daily Range of Temperature.—Degrees Fahr.												
			Yr., 1885.	Months, 1885.											
				Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 18 Stations...§	....	......	18.78	17.03	22.94	22.22	18.25	19.72	22.73	22.09	18.45	20.42	16.81	11.53	13.19
Marquette	U. P.	......	¶	......	......	19.80	17.40	17.30 [a]	21.80	20.20	15.00	20.90	13.50	8.60	15.30
Manistique	U. P.	22.58 [9]	22.09	24.21	26.93	33.24	20.60	23.61	23.70	23.55 [b]	18.74	22.40	16.90	14.80	16.39
Escanaba	U. P.	16.56 [6]	16.62	16.50	20.90	24.50	16.60	17.00	20.60	17.10	15.00	17.50	13.30	8.90	11.50
Traverse City	N. W.	18.61 [4]	20.07	15.68	24.96	28.29	20.67	21.94	25.57	22.23	18.90	21.67	17.35	11.53	12.10
Boyne City	N.	...... [5]	‖	15.94	......	37.94	34.13	28.26	34.70	34.65	22.71	24.97	20.19	12.80	11.52
Mackinaw City	N.	15.65 [2]	16.01	15.53	19.69	24.78	17.57	16.97	20.01	19.06	13.60	14.80	11.77	7.80	10.50
Alpena	N. E.	16.42 [6]	17.33	15.38	19.99	23.53	18.10	16.90	23.10	19.60	16.50	18.70	14.40	9.90	11.80
Harrisville	N. E.	......	21.52	21.16	26.43	25.97	18.30	22.23	29.10	27.26	21.90	21.40	17.84	11.77	14.90
Grand Haven	W.	13.81 [7]	14.85	12.70	16.90	16.70	14.40	17.20	16.50	16.70	13.50	14.80	15.30	12.60	10.90
Reed City	W.	......	24.83	18.97 [a]	29.75	33.48	23.17	28.27 [a]	29.67	29.29	25.42	28.30	22.10	13.77	15.77
Port Huron	B. & E.	16.08 [6]	16.40	16.00	20.70	18.50	16.60	17.20	20.00	16.90	16.00	18.00	14.60	10.20	12.06
Thornville	B. & E.	16.77 [6]	15.82	11.87	21.11	17.81	17.03	17.80 [a]	19.00	18.48	15.45	18.90	14.71	8.23	9.42
Agr'l College	C.	19.87 [4]	19.36	17.40	24.39	20.94	18.97	21.00	23.03	22.52	19.58	21.13	17.81	12.43	13.06
Ionia	C.	21.52 [2]	21.36	18.30 [c]	26.21	23.40	19.28 [b]	15.31	27.50	30.32	24.19	22.67 [d]	18.32	14.47	16.32
Lansing	C.	19.30 [7]	18.43	16.58	22.21	19.03	15.90	17.48	18.70	21.81	20.42	22.80	18.84	13.27	14.10
Swartz Creek	C.	19.77 [2]	19.61	17.97	25.64	20.03	17.70	20.39	23.27	22.97	20.42	22.70	19.52	11.83	12.90
Ann Arbor	S. C.	18.23 [4]	16.07	13.94	18.33	13.66	16.58 [b]	17.60	19.80	20.90	15.35 [e]	18.45	15.95	9.40	12.89
Marshall	S. C.	19.13 [4]	19.49	16.74	22.11	18.65	19.03	21.94	24.83	24.48	21.26	21.70	17.67 [a]	11.73	13.77
Tecumseh	S. C.	22.61 [3]	21.97	21.13 [a]	25.93	21.06	20.90	25.31 [b]	25.36 [c]	25.45	20.97	25.75 [f]	21.74	14.32 [g]	15.68
Birmingham	S. E.	......	**	......	......	21.94	19.82	20.53	22.88	22.13 [a]	18.87	19.50	18.93 [a]	11.87	14.13
Detroit	S. E.	15.86 [7]	16.25	16.55	20.65	16.35	17.12	16.82	19.35	19.07	14.90	15.90	14.40	10.60	13.30

* The names of observers, their places of observation, and the counties in which these places are situated, are stated in Exhibit 1, page 9.

† For counties in each division see Exhibit I, in a paper which follows on weekly reports of diseases.

‡ Numbers in this column state the annual average range of temperature for periods of years ending in each case with Dec. 31, 1885 The small figures above and at the right of numbers which state the range of temperature, denote the number of years included in the average.

§ This line is an average for all stations for which statements nearly complete are given for every month of the year. It does not include the lines for Marquette, Boyne City, and Birmingham.

¶ The average for 10 months in 1885 is 16.98. ‖ For 11 months, 25.26. ** For 10 months, 19.06.

a, b, c. In the columns from January to December, inclusive, the letters a, b, c, etc., stand directly above the numbers from which they refer to the notes below.

a For 30 days. b For 29 days. c For 28 days. d For 27 days. e For 26 days. f For 24 days. g For 22 days.

NOTE.—Graphic representations of statements in Table III, are given in Diagram No. II, page 32.

TABLE IV.—ABSOLUTE HUMIDITY.—*The Average Number of Grains of Vapor of Water in a Cubic Foot of Air for Months and Year 1885, at 18 Stations in Michigan.—Average of Observations made daily at 7 A. M., 2 P. M., and 9 P. M.,* by Observers† for the State Board of Health, and for the U. S. Signal Service.*

Stations in Michigan.† (Those of U. S. Signal Service in Italics.)	Divisions of the State.‡	Grains of Vapor in a Cubic Foot of Air—(Absolute Humidity.)‖													
		Year.		Months—1885.											
		Norm. §	1885	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 18 stations¶	......	......	3.14	1.14	0.94	1.25	2.53	3.62	4.90	6.12	5.29	4.56	3.17	2.50	1.72
Marquette	U. P.	......	**	......	......	0.99	2.06	2.84	[c]3.96	5.11	4.46	3.82	2.68	2.19	1.52
Manistique	U. P.	2.92[9]	2.78	1.06	0.93	1.10	2.10	[a]3.11	4.12	4.77	4.83	4.17	3.04	2.40	1.74
Escanaba	U. P.	2.87[6]	2.68	[a]0.77	0.70	[a]0.90	1.94	2.91	4.18	5.60	4.73	4.06	2.78	2.22	1.42
Traverse City	N. W.	3.34[4]	3.26	1.30	1.01	1.28	2.52	[b]3.46	4.96	6.60	5.40	4.82	3.28	2.53	1.97
Boyne City	N.	......	††	1.33	......	1.22	2.43	3.43	4.63	5.59	4.85	4.33	3.03	2.45	1.88
Mackinaw City	N.	2.85[9]	2.76	1.02	0.82	0.94	2.11	2.86	4.12	5.53	4.79	4.20	2.90	2.31	1.50
Alpena	N. E.	2.92[7]	2.87	1.06	0.80	0.98	2.12	3.27	4.45	5.65	4.93	4.16	[a]3.03	2.42	1.56
Harrisville	N. E.	......	2.61	0.79	0.70	0.83	1.85	3.01	4.13	5.29	4.63	3.96	2.75	2.09	1.34
Grand Haven	W.	3.47[7]	3.14	1.28	1.05	1.42	2.67	3.64	4.52	5.83	5.07	4.70	3.21	2.46	1.82
Reed City	W.	3.07[8]	2.70	[e]0.83	0.66	1.05	2.44	[c]3.09	4.60	[d]5.40	4.69	4.09	2.57	1.90	1.08
Port Huron	B. & E.	3.34[7]	3.20	1.19	1.02	1.23	2.48	3.54	4.96	6.16	[a]5.38	[c]4.69	3.33	2.64	1.73
Thornville	B. & E.	3 74[9]	3.53	1.40	1.14	1.50	2.93	4.34	5.66	6.97	5.71	4.85	3.39	2.65	1.86
Agr'l College	C.	3.54[6]	3.32	1.28	1.03	1.46	2.77	3.90	5.33	6.43	5.48	4.62	3.17	2.47	1.90
Ionia	C.	......	§§	1.28	1.10	1.54	2.79	[a]4.16	5.36	6.43	5.47	[e]4.73	3.45	2.60	......
Lansing‡‡	C.	3.39[7]	3.23	1.18	1.05	1.26	2.65	3.85	5.19	6.26	5.33	4.63	3.15	2.46	1.75
Swartz Creek	C.	3.28[2]	3.19	1.17	0.93	1.23	2.60	3.82	5.15	6.32	5.33	4.47	3.08	2.47	1.75
Ann Arbor¶¶	S. C.	3.38[5]	3.21	1.09	0.87	1.22	2.41	3.56	5.07	6.44	5.44	4.54	3.30	2.66	1.88
Battle Creek	S. C.	......	3.39	1.19	1.02	1.47	2.98	3.93	5.25	6.56	[a]5.69	4.81	[b]3.46	2.58	1.73
Marshall	S. C.	3.64[4]	3.59	1.24	1.05	1.55	3.08	4.25	5.51	6.87	5.97	5.14	3.55	2.79	2.03
Tecumseh	S. C.	3.65[8]	3.60	[c]1.25	1.07	[a]1.63	3.07	[g]4.44	[f]5.65	6.66	5.97	[h]5.24	3 39	[i]2.92	1.86
Birmingham	S. E.	......	‖‖	......	......	1.37	2.82	4.40	5.77	6.93	[b]5.99	[c]5.02	3.50	[d]2.74	1.89
Detroit	S. E.	3.53[9]	3.51	1.36	0.99	1.44	2.84	[a]4.09	5.35	[a]6.78	5.89	4.85	3.60	2.95	2.03

* At the U. S. Signal Service stations for the year 1885, the observations were made at 7 A. M., P M., and 11 P. M., 75th Meridian time. The local time corresponding to these hours is stated in th. star (*) footnote to Table I., page 26.

† The names of observers, their places of observation, and the counties in which these places are situated are stated in Exhibit 1, page 9.

‡ The full names of the divisions and the counties in each division are stated in Exhibit I, in a paper which follows, on weekly reports of sickness.

§ Numbers in this column state the average annual Absolute Humidity for periods of years ending in each case with Dec. 31, 1885. The small figures above and at the right of numbers which state the Absolute Humidity, denote the number of years included in the average.

‖ The number of grains of vapor in a cubic foot of air at each observation was determined from readings of the psychrometer by means of Glaisher's table, Table XII. of the Smithsonian Meteorological and Physical Tables (1859).

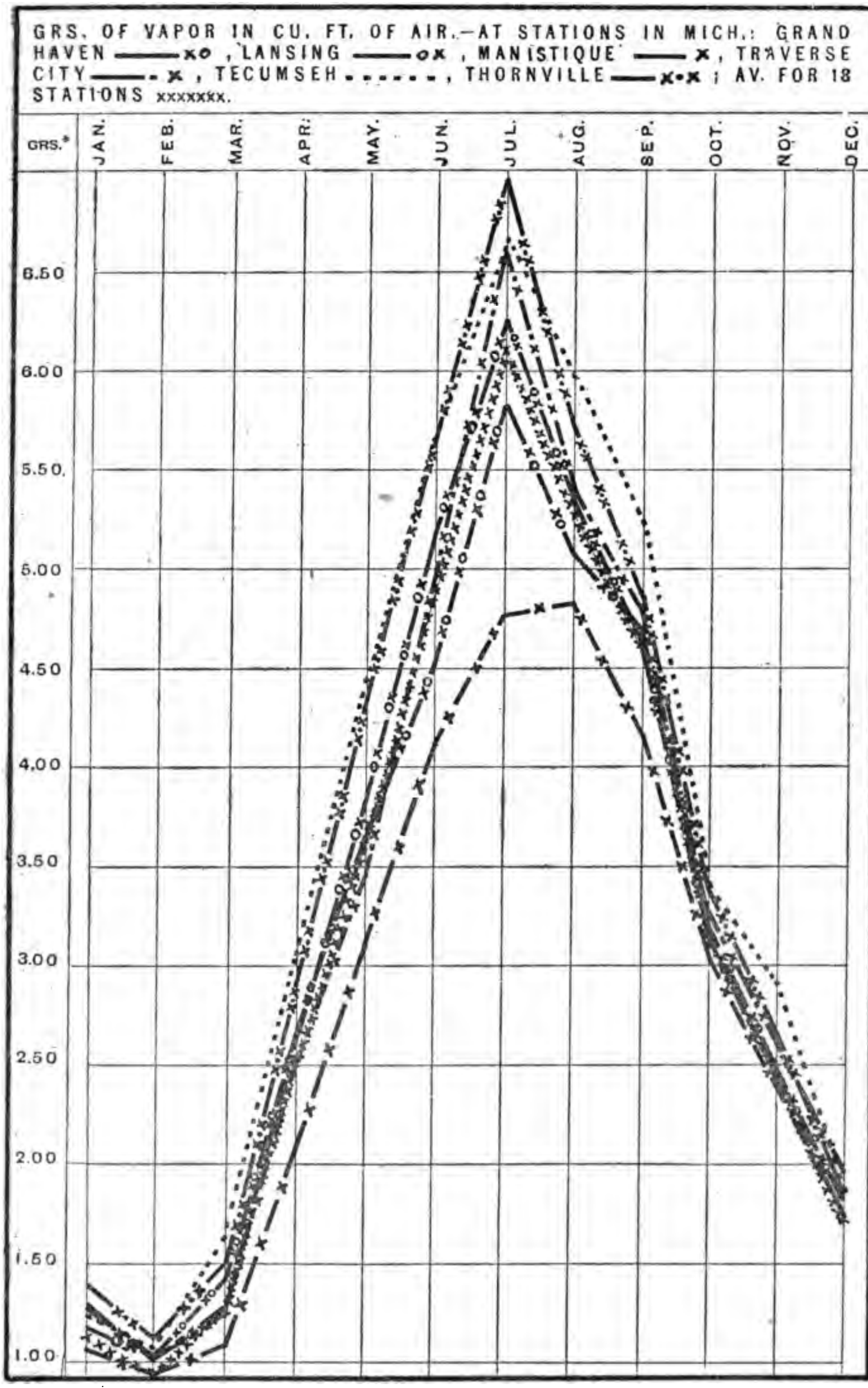
¶ This line is an average for only the stations from which statements, nearly complete, were received for every month in the year. It does not include the lines for Marquette, Boyne City, Ionia, and Birmingham.

** The average for 10 months in 1885 is 2.96. †† For 11 months, 3.52. §§ For 11 months, 3.20. ‖‖ For 10 months, 4.04.

¶¶, ‡‡, a, b, c, d, e, f, g, h, i, See page 36.

The lines for 6 stations in Table IV. are graphically represented in Diagram III., page 35.

DIAGRAM III.—ABSOLUTE HUMIDITY, BY MOS., IN 1885



*Scale, One Grain of Vapor (in a Cu. Ft. of Air) to 1.05 In. Vertically.

H. B. T., Del. Des. by H. B. B.

EXHIBIT 11.—*Average Absolute Humidity, by Year and Months, in 1885, compared with Annual and Monthly Averages for 1884, and for the 9 Years 1877-85.* These Averages are for Groups of several Stations in Michigan.*†

Years, Etc.	Absolute Humidity—Grains of Vapor in a Cubic Foot of Air.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 9 yrs, 1877-85*	3.45	1.38	1.51	1.80	2.70	3.92	5.30	6.13	5.85	4.98	3.72	2.33	1.77
1884 (19 stations*)	3.31	1.09	1.37	1.77	2.42	3.78	5.59	5.40	5.52	5.24	3.72	2.11	1.69
1885 (18 stations*)	3.14	1.14	0.94	1.25	2.53	3.62	4.90	6.12	5.29	4.56	3.17	2.50	1.72
In 1885 **Greater** than Av. for 9 yrs, 1877-85	......	......	......	......	......	......	......	......	......	......	......	0.17	......
In 1885 **Less** than Av. for 9 yrs, 1877-85	0.31	0.24	0.57	0.55	0.17	0.30	0.40	0.01	0.56	0.42	0.55	......	0.05
In 1885 **Greater** than in 1884	......	0.05	......	......	0.11	......	......	0.72	......	......	......	0.39	0.03
In 1885 **Less** than in 1884	0.17	......	0.43	0.52	......	0.16	0.69	......	0.23	0.68	0.55	......	......

* Beginning with the year 1885, allowance must be made for Lansing in Exhibit 11, because of a change in the location of the instruments. The amount of variation by months is shown in Exhibit C, on page 23.

† Thornville and Detroit for 1877-85; Kalamazoo for 1877-83; Mendon for 1877-82; Tecumseh for 1878-85; Battle Creek for 1877-79, 1882, 1885; Otisville for 1878-80, 1882; Marquette for 1879-84; Alpena, Grand Haven, Port Huron, Lansing for 1879-85; Niles for 1878-9, 1881; Nirvana for 1878-9 and first four months of 1880; Reed City for last eight months of 1880 and 1881-5; Benton Harbor, Coldwater for 1877-8; Escanaba for 1880-5; Washington for 1880-3; Petoskey for 1879; Winfield for 1881, 1883; Ann Arbor for 1881-5; Woodmere Cemetery (near Detroit) for 1877-9; Traverse City, Marshall for 1882-5; Harrisville for 1882, 1885; Hastings for 1882; Hillsdale for 1883-4; Parkville for 1882; Manistique, Mackinaw City, Swartz Creek for 1884-5; Ionia for 1884; Agricultural College for 1877-8, 1881-85.

Exhibit 12 states the annual and monthly average at the State Agricultural College for nineteen years, and gives comparisons of 1885 with this average, and with the year 1884. Exhibit 11 states the average of all stations in Michigan, for a period of nine years, and compares 1885 with this average, and with the year 1884. The absolute humidity at each of eighteen stations by months in 1885, is stated in Table IV., page 34.

Foot-notes from page 34.]

¶¶ The computations of Absolute Humidity at Ann Arbor for each month in 1885, except September, October, and December, were furnished by the observer there. All other computations in Table IV. were made at the office of the Secretary of the State Board of Health.

‡‡ Beginning with the year 1885, allowance must be made for Lansing in Table IV., because of a change in the location of the instruments. The amount of the variation by months is shown in Exhibit C, page 23.

[a], [b], [c]. In the columns from January to December, inclusive, the letters [a], [b], [c], stand directly above the numbers from which they refer to the notes below.

[a] For 92 observations. [b] For 91 observations. [c] For 89 observations. [d] For 87 observations.
[e] For 85 observations. [f] For 83 observations. [g] For 82 observations. [h] For 74 observations.
[i] For 73 observations.

EXHIBIT 12.—*Comparison of the Average Absolute Humidity for the Year, and for each Month of the Year 1885, with averages for the nineteen Years 1866–84, and for the Year 1884. Observations made at 7 A. M., 2 P. M. and 9 P. M., daily, by Prof. R. C. Kedzie, at the State Agricultural College, near Lansing, Mich.*

Years, Etc.	Absolute Humidity—Grains of Vapor in a Cubic Foot of Air.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 19 yrs, 1866-84	3.49	1.44	1.56	1.87	2.65	4.02	5.61	6.51	6.04	4.87	3.38	2.17	1.65
1884	3.57	1.28	1.67	2.01	2.58	4.17	6.09	5.94	5.67	5.52	3.87	2.19	1.84
1885	3.32	1.28	1.03	1.46	2.77	3.90	5.33	6.43	5.48	4.62	3.17	2.47	1.90
In 1885 **Greater** than Av. for 19 yrs, 1866-84	......	......	......	......	0.12	......	......	......	......	......	......	0.30	0.25
In 1885 **Less** than Av. for 19 yrs, 1866-84	0.17	0.16	0.53	0.41	......	0.12	0.31	0.08	0.56	0.25	0.21	......	......
In 1885 **Greater** than in 1884	......	0	......	......	0.19	......	......	0.49	......	......	......	0.28	......
In 1885 **Less** than in 1884	0.25	0	0.64	0.55	......	0.27	0.76	......	0.19	0.90	0.70	......	0.94

EXHIBIT 13.—*Average Relative Humidity, by Year and Months, in 1885,* compared with Annual and Monthly Averages for 1884, and for the Eight Years, 1878–1885. These Averages are for Groups of several Stations in Michigan.*†

Years, Etc.	Per Cent of Saturation.—Relative Humidity.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 8 yrs, 1878 85*	75	81	80	76	68	68	72	72	74	75	64	79	82
1884 (19 stations*)	75	80	82	77	67	70	73	71	73	73	75	79	83
1885 (18 stations*)	76	80	80	77	72	69	70	71	78	75	79	82	82
In 1885 **Greater** than Av. for 8 yrs, 1878-85	1	......	......	1	4	1	......	......	4	0	15	3	0
In 1885 **Less** than Av. for 8 yrs, 1878-85	......	1	0	......	......	......	2	1	......	......	......	......	......
In 1885 **Greater** than in 1884	1	0	......	......	5	......	......	......	5	2	4	3	......
In 1885 **Less** than in 1884	......	......	2	0	......	1	3	0	......	......	......	......	1

* Beginning with the year 1885, allowance must be made for Lansing in Exhibit 13, because of a change in the location of the instruments. The amount of the variation is shown in Exhibit D, on page 23.

† Thornville, Tecumseh, Detroit for 1878-85; Kalamazoo for 1878-83; Mendon for 1878-82; Otisville for 1878-80, 1882; Nirvana for 1878-9; Nirvana and Reed City for 1880; Ann Arbor, Reed City for 1881-85; Niles for 1878-9, 1881; Marquette for 1879-84; Alpena, Grand Haven, Port Huron, Lansing for 1879-85; Woodmere Cemetery (near Detroit) for 1878-9; Battle Creek for 1878-9, 1882, 1885; Agricultural College for 1878, 1881-5; Escanaba for 1880-5; Washington for 188[illegible]; Coldwater for 1878; Petoskey for 1879; Mallory Lake and Hudson for 1881; Marshall, Traverse City for 1882-5; Hillsdale for 1882-4; Hastings for 1882; Harrisville for 1882, 1885; Winfield for 1883; Manistique, Mackinaw City, Swartz Creek for 1884-5; Ionia for 1884.

Foot-notes from page 38.]

¶ The average for 10 months in 1885 is 75. ‖ For 11 months, 75. ** For 11 months, 78. †† For 10 months, 84.

§§ Beginning with the year 1885, allowance must be made for Lansing in Table V., because of a change in location of the instruments. The amount of the variation by months is shown in Exhibit D, page 23. [a], [b], [c]. In the columns from January to December, inclusive, the letters [a], [b], [c], etc., stand directly above the numbers from which they refer to the notes below.

[a] For 92 observations. [b] For 91 observations. [c] For 90 observations. d For 89 observations.
e For 87 observations. [f] For 85 observations. [g] For 83 observations. [h] For 74 observations.
i For 73 observations.

TABLE V.—RELATIVE HUMIDITY.—*Average Per Cent. of Saturation of the Atmosphere with Vapor of Water during the Year, and during each Month of the Year 1885, at 18 Stations in Michigan.—Average of Observations made Daily at 7 A. M., 2 P. M., and 9 P. M.,* by Observers† for the State Board of Health, and for the U. S. Signal Service.*

Stations in Michigan.† (Those of the U. S. Signal Service in Italics.)	Divisions of the State.†	Per Cent. of Saturation—Relative Humidity. Year. Norm. ‡	1885.	Months, 1885. Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 18 Stations§	....	......	76	80	80	77	72	69	70	71	78	75	79	82	82
Marquette	U. P.	......	¶	......	......	81	73	72	72[d]	64	78	69	77	83	84
Manistique	U. P.	80[2]	79	92	91	78	74	67[a]	72	65	77	76	83	87	89
Escanaba	U. P.	74[6]	73	72	69	69[a]	68	67	66	72	77	74	78	83	81
Traverse City	N. W.	84[4]	86	95	94	91	80	77[c]	74	81	83	82	88	89	96
Boyne City	N.	......	‖	94	......	93	74	71	67	70	78	77	84	89	94
Mackinaw City	N.	76[2]	76	76	76	77	76	74	73	76	80	78	76	78	76
Alpena	N. E.	75[7]	80	78	75	65	79	80	75	81	84	79	87[a]	88	85
Harrisville	N. E.	......	61	58	61	53	55	60	59	63	66	64	65	67	66
Grand Haven	W.	75[7]	77	78	78	77	72	71	72	75	81	76	81	74	84
Reed City	W.	68[8]	64	57[f]	59	73	69	52[d]	60	60	73	70	71	69	59
Port Huron	B. & E.	77[7]	80	81	83	80	76	77	75	77	80	79	84	84	83
Thornville	B. & E.	79[8]	80	92	94	88	73	72	73	73	79	75	68	81	87
Agr'l College	C.	79[22]	81	90	91	88	73	67	75	71	80	78	83	84	90
Ionia	C.	......	**	85	88	88	72	70[a]	69	67	77	74[f]	85	86	...
Lansing §§	C.	71[7]	77	83	89	76	67	67	70	68	79	76	81	81	85
Swartz Creek	C.	76[2]	77	84	87	77	68	67	71	69	79	75	78	82	84
Ann Arbor	S. C.	78[5]	79	85	85	76	73	67	72	72	79	76	83	88	88
Battle Creek	S. C.	......	71	75	77	74	68	61	65	65	74[a]	70	72[b]	75	71
Marshall	S. C.	76[4]	77	80	78	80	74	69	70	69	79	76	70	86	89
Tecumseh	S. C.	79[8]	82	87[d]	89	87[a]	80	75[g]	75[g]	69	82[b]	78[h]	88	90[i]	86
Birmingham	S. E.	......	††	......	......	82	77	78[a]	81	80[a]	87	85[d]	88	89[e]	88
Detroit	S. E.	71[8]	73	69	69	72	70	70	71	71	78	71	77	81	81

NOTE.—The tri-daily observations with the psychrometer at Marquette, Escanaba, Mackinaw City, Grand Haven, Port Huron, and Detroit for 1885, were reduced (by tables in "Signal Service Order No. 41, 1881, and in Instructions to Voluntary Observers," 1882), and the monthly means for those months were computed, by the observers at those stations, November excepted, at Mackinaw City, and January, February, and July at Marquette. In all other cases the observations were reduced by Guyot's table, in Smithsonian Meteorological Tables, or by a table substantially the same as that. Computations for Ionia for the first four months in 1885, and for Ann Arbor for each month in 1885, except July and December, were made by the observers there. All other computations in Table V. were made at the office of the State Board of Health.

* At the stations of the U. S. Signal Service for the year 1885, the observations were made at 7 A. M., 3 P. M., and 11 P. M., 75th Meridian time. The corresponding local time for each of these stations is stated in the star (*) foot-note to Table I., page 26.

† The names of observers, their places of observation, and the counties in which these places are situated, are stated in Exhibit 1, page 9 The full names of the divisions and the counties in each division are stated in Exhibit I, in a paper which follows, on weekly reports of diseases.

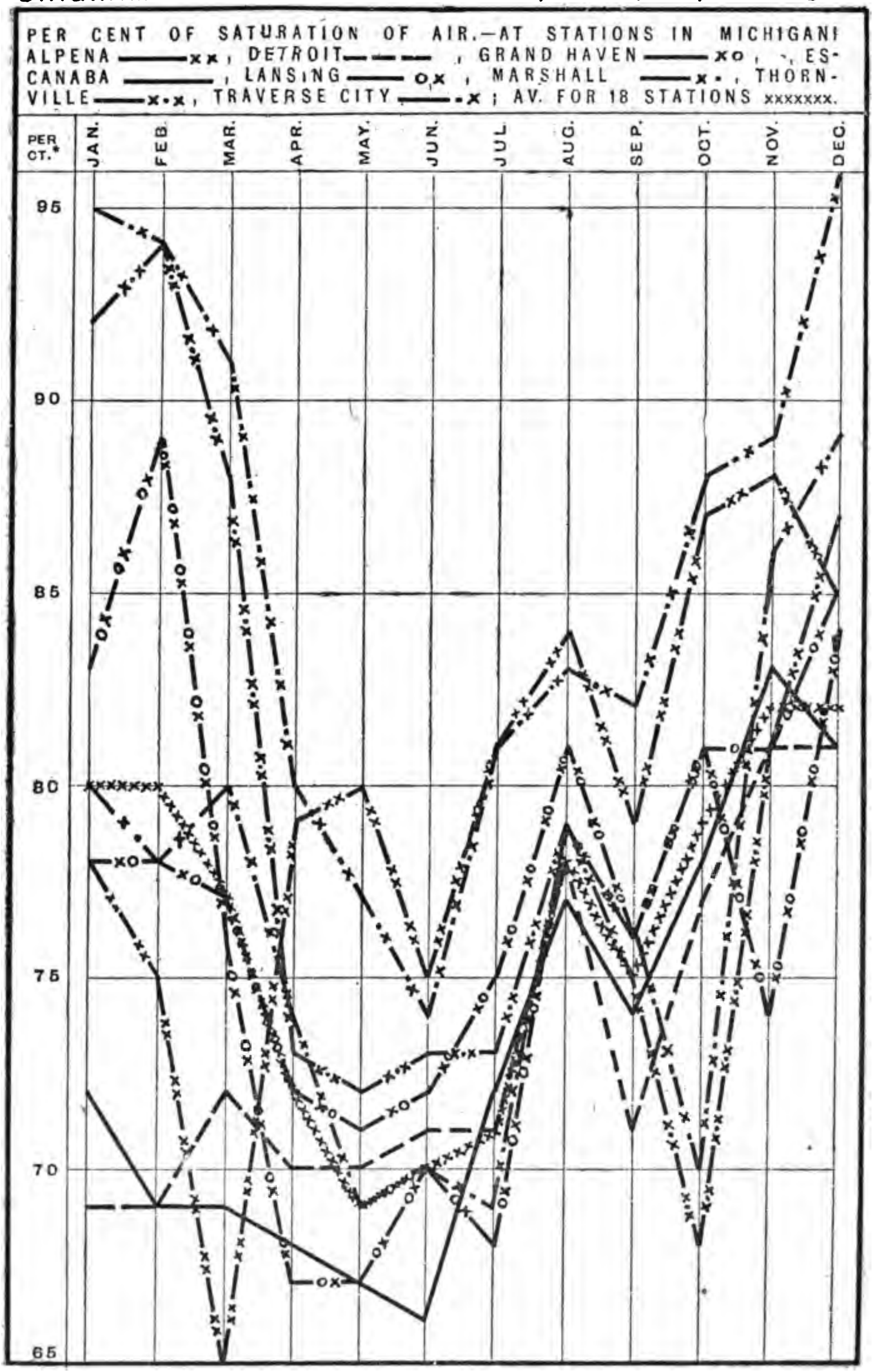
‡ Numbers in this column state the average annual Relative Humidity for periods of years ending in each case with Dec. 31, 1885. The small figures above and at the right of the numbers which state the Relative Humidity, denote the number of years, including the average.

§ This line is an average for only the stations from which statements, nearly complete, were received for every month in the year. It does not include Marquette, Boyne City, Ionia, and Birmingham.

¶, §§, a, b, c, d, e, f, g, h, i, See page 37.

Graphic representations of 8 representative lines in Table V are given in Diagram IV., page 39.

DIAGRAM IV.—RELATIVE HUMIDITY, BY MOS., IN 1885.



*SCALE, TEN PER CENT OF SATURATION TO 2.06 IN. VERTICALLY.

H. B. T., DEL. DES. BY H. B. B.

EXHIBIT 14 —*Comparison of the Average Relative Humidity of the Air (Per Cent of Saturation) for the Year and for each Month of the Year 1885, with Averages for the 21 Years, 1864–84, and for 1884. Observations made at 7 A. M., 2 P. M. and 9 P. M. Daily, by Prof. R. C. Kedzie, at the State Agricultural College near Lansing, Michigan.*

Years, Etc.	Per Cent of Saturation.—Relative Humidity.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 21 years, 1864-84	79	86	86	84	71	69	76	74	77	80	80	82	86
1884	81	93	92	86	68	73	76	76	75	76	80	83	90
1885	81	90	91	88	73	67	75	71	80	78	83	84	90
In 1885 **Greater** than Av. for 21 yrs, 1864-84	2	4	5	4	2	......	......	......	3	......	3	2	4
In 1885 **Less** than Av. for 21 yrs, 1864-84	......	......	......	......	......	2	1	3	......	2	......	......	......
In 1885 **Greater** than in 1884	0	......	......	2	5	......	......	......	5	2	3	1	0
In 1885 **Less** than in 1884	0	3	1	......	......	6	1	5	......	......	......	......	......

FOGS.

For the year 1885, fog was reported at 240 morning observations, at 84 afternoon observations (at about 2 P. M.), at 113 evening observations (at about 9 P. M.), and 75 times during the day, no special time being mentioned, in many cases the same fog, or fog at the same time, being reported by different observers. Fog was reported at one or more stations at some time during the day, on 202 days.

EXHIBIT 15.—*Number of Different Days on which Fog was Observed at one or more of 21 Stations* in Michigan in 1885, and in each Month of the Year 1885.*

Year, 1885.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
202	14	20	12	16	18	13	13	22	19	24	10	21

NOTE.—Graphic representations of Statements in Exhibit 15 are given in Diagram No. V., page 41.

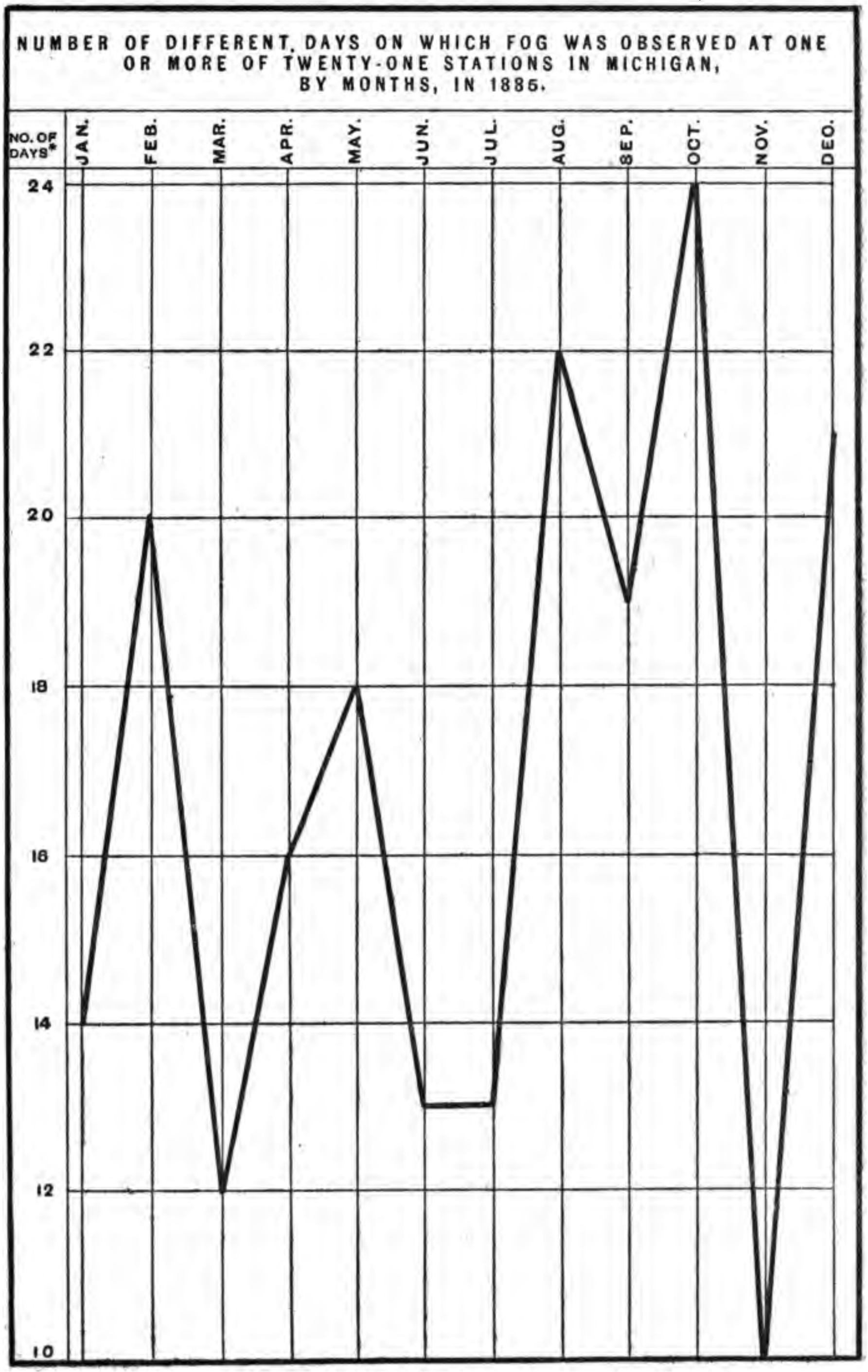
* This exhibit contains statements only for those localities from which reports were received for every month of the year, as follows: Manistique, Escanaba, Traverse City, Mackinaw City, Alpena, Grand Haven, Reed City, Port Austin, Port Huron, Thornville, Agricultural College, Ionia, Lansing, Swartz Creek, Ann Arbor, Battle Creek, Kalamazoo, Marshall, Parkville, Tecumseh and Detroit.

EXHIBIT 16.—*Number of Observations at which Fog was Observed in Michigan in 1885, and in each Month of the Year 1885. Observations taken three times Daily at 21 Stations.**

Year, 1885.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
512	22	45	19	29	67	40	31	44	34	84	23	74

* This exhibit contains statements only for those localities from which registers were received for every month of the year, as stated in a foot-note to Exhibit 15, above.

DIAGRAM V.—CONCERNING FOGS IN MICHIGAN, IN 1885.



*Scale, One Day to .45 In. Vertically.

H. B. T., Del. Des. by H. B. B.

EXHIBIT 17.—*Number of different Days on which Fog was recorded in 1885, and in each*

Stations in Michigan.*	No. of days in 1885.	January. Day of Month.	January. Hour of Observation. A. M.	January. Hour of Observation. P. M.	February. Day of Month.	February. Hour of Observation. A. M.	February. Hour of Observation. P. M.	Line Number.
Marquette	12							1
								2
Manistique	17	0			25	7		3
								4
								5
								6
								7
								8
								9
Escanaba	119	3,12,16,23,30			2	6:12	2:12	10
		6, 31	6:12	2:12	9, 15	6:12	2:12 & 10:12	11
		24	6:12		10, 25, 28	6:12		12
		20, 25		2:12	4, 6, 7		2:12	13
		5, 11, 22		10:12	27	6:12	10:12	14
		19			3, 26		2:12 & 10:12	15
					1,14,16,20,21			16
Moorestown	4	0			0			17
								18
								19
Traverse City	1	0			0			20
Boyne City	3	0						21
Mackinaw City	23	0			25	6:22		22
								23
Alpena	15	0			0			24
								25
								26
								27
								28
Grand Haven	61	6	6:15		3	6:15	2:15	29
					27	6:15		30
								31
								32
Pentwater	4							33
Reed City	8	0			0			34
Grand Rapids	1	11		9				35
East Saginaw	4							36
Port Austin	6	0			0			37
								38
								39
Port Huron	48	0			26	6:30		40
					3, 24, 25		10:30.	41
								42
Thornville	8	30	7 to 10		3	Morning.	Evening.	43
Agricultural College	5	30		9	0			44
Ionia	18	0			0			45
								46
Lansing, S. B. of H.	14	0			3, 7	7		47
Swartz Creek	9	0			0			48
								49
								50
Ann Arbor	11	30		Eve and night.	0			51
Battle Creek	5	0			3	5 to 11		52
					27	4 to 8		53
Hudson	5	11		Evening.	0			54
Kalamazoo	3	0			0			55
Marshall	2	0			0			56
Parkville	28	30		Night.	3, 18, 21, 23		Night.	57
					27	Morning.		58
Tecumseh	2	30		9	0			59
Birmingham	14							60
								61
Detroit	15	0			0			62

* The names of observers, their places of observation, and the counties in which these places are situated, are stated in Exhibit 1, page 9.

Month the Dates and Hours of Observation when Fogs were recorded at 29 Stations in Michigan.

Line Number.	March.			April.			May.			June.		
	Day of Month.	Hour of Observation. A. M.	Hour of Observation. P. M.	Day of Month.	Hour of Observation. A. M.	Hour of Observation. P. M.	Day of Month.	Hour of Observation. A. M.	Hour of Observation. P. M.	Day of Month.	Hour of Observation. A. M.	Hour of Observation. P. M.
1	0			0			4		Night till	12		9
2							5	6:19 till	5:40	13	6:19	10:19
3	3	7		15	8 to 11		24	7	9	7	6 to 9	
4	30		6 to 8:30	21	2 to 12 M		24, 25		Night.	12		3 to 6
5										13	8 to	1
6										14	6 to 10	
7										15	8 to 10	
8										20	5 to 10	
9										26	12 M to	5
10	3,13,30	6:12		2, 11, 15,21	6:12		17	6:12	2:12	21, 27	6:12	
11	17, 26		2:12	7, 12	6:12	2:12	16, 24		10:12	13,14, 15,20		
12	13, 29		10:12	10,14,20		2:12 & 10:12	7, 8, 25					
13	14	6:12	2:12 & 10:12	1, 27		10:12						
14	15,19, 25,31			5,23,28								
15												
16												
17	0			21	7 to 8		23	7 to 10				
18							30		9			
19							31	7 to 8				
20	0			0			30		9			
21	0			0			0			0		
22	26	7 to 11:15		23	6:22		16, 17, 22	6:22	2:22	4,13,27	6:22	
23							23, 24	6:22		7	6:22	2:22
24	0			21	6 to 8		5		6:50 to 10	0		
25							6		7:40†			
26							22		Night till			
27							23	7 till	1, 5 till night.			
28							24		3:00			
29	13		2:15	15	6:15	2:15	13, 23, 25	6:15		4,14,28	6:15	
30	18		10:15	19		10:15	31	6:15	2:15	3, 7	6:15	2:15
31				23	6:15	10:15	5, 18, 19		2:15 & 10:15	21		2:15
32							30	6:15	2:15 & 10:15	20		2:15 & 10:15
33												
34	0			0			2		2	0		
35	0			0								
36												
37	0			0			23	7		28		
38							22		2			
39							6		9			
40	0			0			24	6:30		0		
41							23	6:30	2:30			
42							18, 22, 30		10:30			
43	0			0			0			0		
44	0			0			23	7		4	7	
45	0			0			13, 23	5:30 to 7, 5:30 to 7:30		2	Morning	
46										27		Night.
47	0			0			23	Morning.		4	7	
48	0			0			22	9 till	2 till 9			
49							23	till 6				
50							24	4 till 6:30				
51	0			0			24	7		0		
52	0			0			12	5 to 8		4	nearly all day	
53												
54	0			0			19, 23	Morning.		3		Evening.
55	0			0			23	A. M.		0		
56	0			0			0			0		
57	0			24			13,14,19, 23,31			2, 4		
58												
59	0			0			0			0		
60	0			0			19, 23, 24	7		4	7	
61							22		9			
62	0			0			0			0		

NOTE.—Registers were received, but with no fog recorded thereon, from Harrisville for each month in 1885; from Hillsdale, for January. A cipher (0) indicates that a monthly register was received from the station with no fog recorded thereon.

† Lifted in night.

EXHIBIT 17.——CONTINUED.—*Dates when*

Stations in Michigan.*	July.			August.			September.			Line Number.
	Day of Month.	Hour of Observation.		Day of Month.	Hour of Observation.		Day of Month.	Hour of Observation.		
		A. M.	P. M.		A. M.	P. M.		A. M.	P. M.	
Marquette	19		2:11	18,29	6:11		26		10:11	1
	21	6:11	2:11							2
	23		10:11							3
	28	6:11								4
Manistique	15	6 to 10		0			21	4 to 8:30		5
Escanaba	15,24,29,30	6:12		7,21,28	6:12		13,21,23,27	6:12		6
	23		10:12	29	6:12	2:12	8		2:12	7
	20			6,8,20		10:12	12		10:12	8
				4,9,18						9
										10
Traverse City	0			0			0			11
Boyne City	25	7								12
Macki'w City	5	early till	5	9	early till 9		8, 13	A. M.		13
	24	early till 9								14
	25	early till 8:30								15
Alpena	24		11:30 till	0			0			16
	25	6:26 till	Night.							17
										18
G'd Haven	15,25	6:15		9,11,15 16,19,22 26,30,31	6:15		5,6,7,19,27	6:15		19
	21		2:15	3		2:15	13		2:15	20
	24		10:15	15,29		10:15	18	6:15	2:15,10:15	21
							24, 26		2:15	22
							14			23
Pentwater							13		5	24
							18	8 till noon.		25
Reed City	0			31	7		18	7		26
										27
East Saginaw							0			28
Port Austin	0			0			18	7		29
Port Huron	19,20,21, 25,28	6:30		11,13,17, 20,31	6:30		15,21,25	6:30		30
				10		10:30	27	6:30	10:30	31
							11		10:30	32
							28, 29			33
Thornville	0			0			0			34
										35
Agr'l College	0			0			0			36
Ionia	31		Night.	8	till 7:30		0			37
				29		Night.				38
				30	till 8					39
Lansing, S. B. of H.	25	early till 8		8	till 6:55		0			40
				15	till 7:40					41
										42
										43
Swartz Creek	31	5 to 7		0			0			44
										45
										46
										47
Ann Arbor	0			0			0			48
										49
Battle Creek	0			0			0			50
Hudson	0			0						51
Kalamazoo	11	4 to 7:30		0			0			52
	25		3:55 to 6:30							53
Marshall	0			8, 31	7		0			54
Parkville	25			7,8,30,31			6,19,28			55
Tecumseh	0			0			0			56
Birmingham	0			29	7		12, 21	7		57
Detroit	0			17,20	6:28		0			58
										59

* The names of observers, their places of observation, and the counties in which these places are situated are stated in Exhibit 1, page 9.

Fogs were Recorded in 1885.

Line Number.	October.			November.			December.		
	Day of Month.	Hour of Observation.		Day of Month.	Hour of Observation.		Day of Month.	Hour of Observation.	
		A. M.	P. M.		A. M.	P. M.		A. M.	P. M.
1	0			12	6:11		0		
2									
3									
4									
5	2	to 10		0			0		
6	2,11,13,16,26	6:12		7,17,18	6:12		4	6:12	2:12
7	25		10:12	13		2:12	6 to 10 inclusive.	6:12	2:12& 10:12
8	20, 31			4, 12		10:12	19 to 23 inclusive.	6:12	2:12& 10:12
9							29 to 31 inclusive.	6:12	2:12& 10:12
10							12		
11	0			0			0		
12	16	7					22	7	
13	2, 12, 16	A. M.		7			30	6:22	2:22
14									
15									
16	2		1 to 4	7	6:26		20		9 to 11:15
17	16	6:26	10:26	8	10:45	Night till.	22		Night till.
18							23	6:00	
19	16, 18	6:15		4		10:15	1	6:15	10:15
20	1, 22, 23, 26		10:15	18	6:15		28		2:15
21							21		2:15,10:15
22							25		10:15
23							29	6:15	2:15,10:15
24	16	7 to 9		0			17	7 to 9	
25									
26	12, 15, 22	7		0			1	7	
27	14		9						
28	11, 15, 16			0			1		
29	0			0			9	till noon.	
30	1,9,10,11,16, 17,24,25	6:30		17, 30	6:30		2, 30	6:30	
31	11, 13		10:30	4, 5, 18			8		10:30
32	12, 18						29		2:30,10:30
33							17		
34	2, 3, 12, 28	till 8		0			29		Night.
35	16		Evening.						
36	2, 15	7		0			0		
37	6,8,10,11,12, 15,16,17,22			0			29		
38									
39									
40	2	till 10		5	7				
41	9	till 8		18		2:30 till 3:50	28	till 9:50	
42	15	till 8:30							
43	16	till 7:30							
44	1, 11, 16	till 7		0			0		
45	1		10 till						
46	2	9							
47	15	1 to 8:30							
48	9,10,11,12, 13,18,25,31	7		0			0		
49	24	7	9						
50	0			0			29		Evening.
51	0			0			29	Morning.	
52	0			0			0		
53									
54	0			0			0		
55	9, 16, 18			0			18, 28, 29		
56	15	7		0			0		
57	11, 12, 15	7		6	7		17, 18	7	
58	12,17,21,24,25	6:28		6, 18		2:28	1	2:28	
59	23, 28		10:28	30		2:28,10:28	17, 29		10:28

TABLE VI.—*Average Per Cent of Cloudiness for the Year, and for each Month of the Year 1885, at each of 21 Stations in Michigan, and also the Average for 20 of the same Stations. Average of Observations made Daily at 7 A. M., 2 P. M., and 9 P. M., * by Observers for the State Board of Health, † and for the U. S. Signal Service.*

Stations in Michigan.† (Those of the U. S. Signal Service in italics.)	Division of the State.‡	Average Per Cent of Cloudiness.													
		Year.		Months. 1885.											
		Norm. ‖	1885.	Jan.	Feb.	Mar	Apr.	May.	J'ne.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 20 stations..§	......	......	57	67	57	51	58	50	41	41	54	44	59	84	81
Marquette..........	U. P.	......	¶	......	......	45	53	39	38	44	59	47	68	92	81
Manistique..........	U. P.	52[2]	54	58	60[g]	47	55[c]	41	37[f]	28[a]	56	39[c]	61[a]	87	81
Escanaba..........	U. P.	58[6]	59	55	63	52[a]	62	49	51	46	63	50	61	86	74
Traverse City..........	N. W.	60[4]	61	90	63	55	59	51	37	39	59	48[d]	62[b]	85[c]	89[a]
Boyne City..........	N.	......	**	82	......	46	51	43	37	36	57	36	57	83	80
Mackinaw City..........	N.	59[2]	58	72	66	46	53	43	42	38	56	45	61	83	85
Alpena..........	N. E.	57[7]	56	64	67	54	52	46	42	37	53	41	62	83	71
Harrisville..........	N. E.	......	59	64	62	48	50	52	40	43	59	48	67	89	83
Grand Haven..........	W.	58[7]	62	89	69	58	63	41	37	47	52	48	66	88	82
Reed City..........	W.	61[8]	62	84[f]	52	53	56	62[l]	47	42[d]	67	49[c]	67[d]	83[c]	83[a]
Port Austin..........	B. & E.	......	37	43[n]	23	23	33	25	21[k]	18[i]	29[o]	24[i]	47[p]	84[h]	72[m]
Port Huron..........	B. & E.	58[7]	55	59	54	46	51	43	36	40	55	43	60	88	82
Thornville..........	B. & E.	53[9]	52	60	51	47	52	43	38	34	44	34	58	80	79
Agricultural College	C.	58[22]	58	75	49	52	60	55	43	43	52	44	60	79	82
Ionia..........	C.	61[3]	61	74	61	55	64	53	43	44	50	52[n]	66[e]	80	86[f]
Lansing..........	C.	55[7]	56	63	53	46	58	49	40	42	50	40	63	80	82
Swartz Creek..........	C.	54[2]	55	60	56	45	58	53	36	41	51	37	63	83	79[a]
Ann Arbor..........	S. C.	59[6]	60	65	53	55	61	63	48	47	57	41	63	85	81
Battle Creek..........	S. C.	56[4]	55	59	55	45	60	51	40	40	52	47	51[a]	75	85[b]
Kalamazoo..........	S. C.	68[9]	68	83	67	59	74	66	59	65	63	61	37[d]	89[e]	89
Marshall..........	S. C.	56[5]	54	63	55	57	58	53	39	42	48[a]	39	37	82	79
Tecumseh..........	S. C.	49[9]	49	50[e]	49	51	55	47[e]	27[g]	29	46	26	56[a]	82[j]	69
Birmingham..........	S. E.	......	††	......	......	53	59	56[c]	45	46[c]	58[e]	39	62[e]	85[d]	79
Detroit..........	S. E.	56[7]	53	53	44	54	57	48	38	34	49	39	57	85	77

* At stations of the U. S. Signal Service the observations were made at 7 A. M., 3 P. M., and 11 P. M., 75th meridian time. The corresponding local time for each of these stations is stated in the star (*) footnote to Table I., page 26.

† The names of observers, their places of observation, and the counties in which these places are situated, are stated in Exhibit 1, page 9.

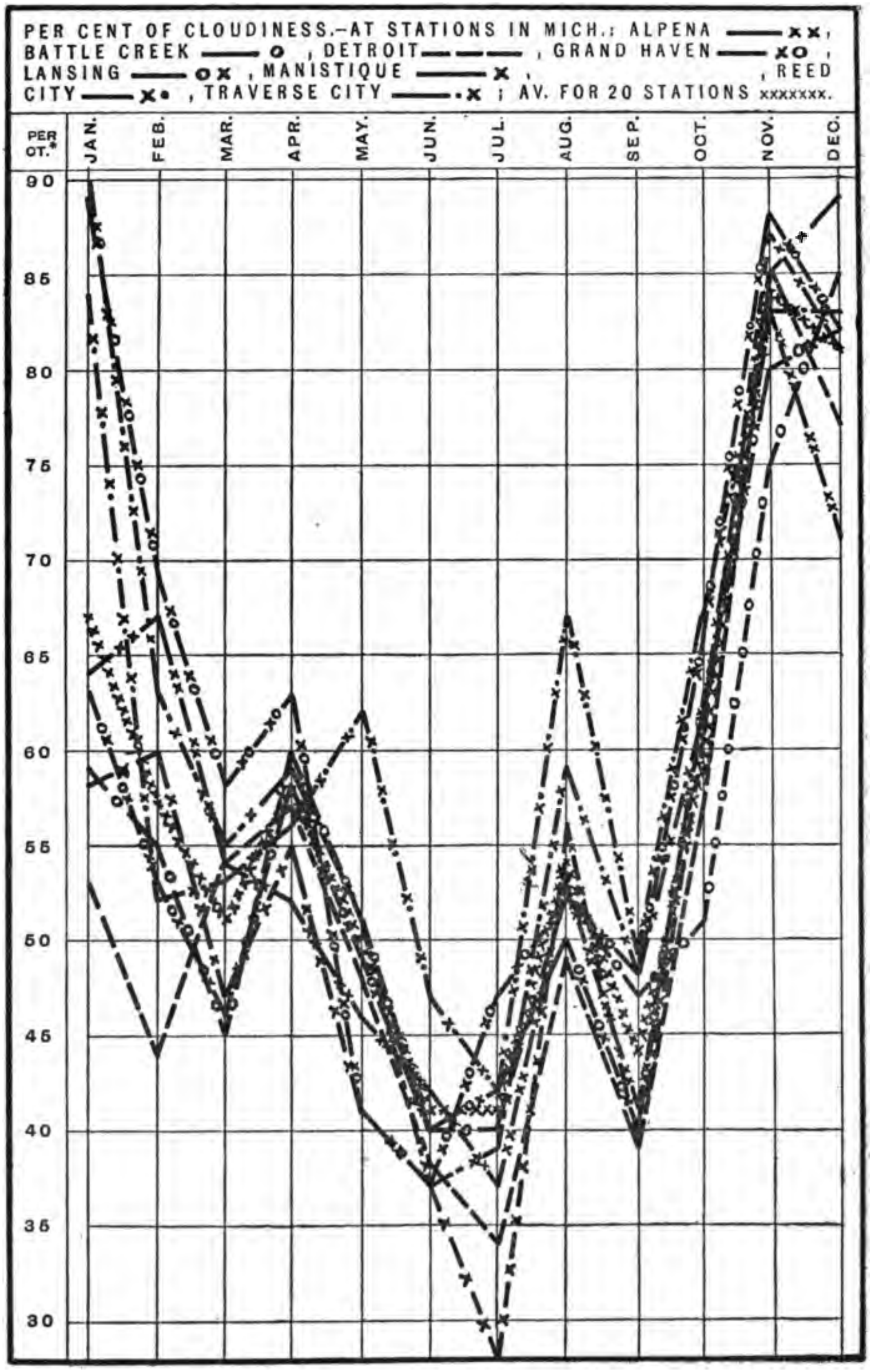
‡ The full names of divisions and the counties in each division are stated in Exhibit I, in a paper which follows, on weekly reports of sickness.

‖ Numbers in this column state the average per cent of cloudiness for periods of years ending in each case with Dec. 31, 1885. The small figures above and at the right of numbers which state the per cent of cloudiness, denote the number of years included in the average. Computations of average per cent of cloudiness were made and furnished by the observers at Marquette, Jan., Feb., and May excepted; Manistique, Mackinaw City, October excepted; Alpena, Grand Haven, Port Huron, Ionia, June to December excepted, and Ann Arbor, August excepted, for each month in 1885. All other computations in Table VI., were made at the office of the State Board of Health.

§, ¶, a, b, c, See page 49.

Graphic representations of 8 representative lines in this table are given in Diagram No. VI., page 47.

DIAGRAM VI.—AV. PER CT. OF CLOUDINESS, MOS., 1885.



*SCALE, TEN PER CENT TO 1.03 IN. VERTICALLY.

H. B. T. DEL. DES. BY H. B. B.

EXHIBIT 18.—*Average Per Cent of Cloudiness, by Year and Months, in 1885. Compared with Annual and Monthly Average for 1884, and for the nine Years, 1877-85. These Averages are for Groups of several Stations in Michigan.**

Years, Etc.	Per Cent of Cloudiness.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 9 y'rs, 1877-85*	56	68	61	60	52	48	47	42	43	45	58	69	78
1884—(21 stations*)	57	73	78	58	53	52	40	48	41	42	55	62	80
1885—(20 stations*)	57	67	57	51	58	50	41	41	54	44	59	84	81
In 1885 **Greater** than Av. 9 y'rs, 1877-85	1	......	......	......	6	2	......	......	11	......	1	15	3
In 1885 **Less** than Av. 9 years, 1877-85	......	1	4	9	......	......	6	1	......	1	......	......	......
In 1885 **Greater** than in 1884	0	......	......	......	5	......	1	......	13	2	4	22	1
In 1885 **Less** than in 1884	......	6	21	7	......	2	......	7	......	......	......	......	......

* Thornville, Kalamazoo, Tecumseh, for 1877-85; Mendon for 1877-83; Battle Creek for 1877-80 and 1882-85; Nirvana for 1877-79 and for first four months of 1880; Reed City for the last eight months of 1880, 1881-85; Detroit for 1877, 1879-85; Niles for 1878-81; Benton Harbor for 1877-78, 1880; Coldwater, Woodmere Cemetery (near Detroit) for 1877-79; Otisville for 1878-80, 1882; Marquette for 1879-84; Alpena, Grand Haven, Port Huron, Lansing for 1879-85; Washington for 1879-83; Ypsilanti for 1877, 1879; Agricultural College for 1877, 1881-85; Petoskey for 1878-79; Escanaba, Ann Arbor, for 1880-85: Fife Lake for 1877; Ionia for 1880, 1883-85; Adrian for 1880; Hillsdale for 1880, 1882 84; Marshall for 1881-85; Parkville for 1881-82; Winfield for 1881, 1883; Hudson and Mallory Lake for 1881; Harrisville for 1882, 1885; Hastings for 1882; Traverse City for 1882-85; Port Austin for 1883; Manistique, Mackinaw City, Swartz Creek for 1884-85.

EXHIBIT 19.—*Comparison of the Average Per Cent of Cloudiness in the Year and each Month of the Year 1885, with Averages for the Twenty-one Years, 1864-84, and for the Year 1884. Observations made at 7 A. M., 2 P. M., and 9 P. M., Daily, by Prof. R. C. Kedzie, at the State Agricultural College, near Lansing, Mich.*

Years, Etc.	Per Cent of Cloudiness.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 21 y'rs, 1864-84	58	72	65	63	56	51	50	46	46	49	59	67	76
1884	58	77	85	61	57	50	41	46	36	36	53	61	87
1885	58	75	49	52	60	55	43	43	52	44	60	79	82
In 1885 **Greater** than Av. for 21 y'rs, 1864-84	0	3	......	......	4	5	......	......	6	......	1	12	6
In 1885 **Less** than Av. for 21 y'rs, 1864-84	0	......	16	11	......	......	7	3	......	5	......	......	......
In 1885 **Greater** than in 1884	0	......	......	......	3	5	2	......	16	8	7	18	......
In 1885 **Less** than in 1884	0	2	36	9	......	......	......	3	......	......	......	......	5

EXHIBIT 20.—*Dates of Auroras Observed and recorded at Fifteen Stations in Michigan, during the Year 1885.*

Stations.	Dates of Auroras Recorded in 1885.											
	Jan.	Feb.	March.	April.	May.	June.	J'ly.	Aug	Sept.	Oct.	Nov.	Dec.
Marquette	......	....	....	......	27	1, 24	....	1	4, 14, 15	8, 12, 30	......	....
Manistique	......	5	15, 20	13	10,11,13,27	....	17	1	2,3,15,16,18	8,27,28,30	9	1, 7
Escanaba	8,9,17	5, 6	13,15,16,20	13	11, 27	1,24, 25, 26	....	....	15	8, 28, 30	9, 10	1, 6
Boyne City	......	....	....	......	11, 31	25	....	....	....	11	......	....
Mackinaw City	......	....	6, 13, 15, 16, 20, 26	......	....	....	....	....	4, 15, 16	11,12,29,30	9,10,7	1, 2
Alpena	......	5	15, 20	13	11, 13, 27	24	....	....	3, 4, 27	15, 30	7	....
Grand Haven	......	5	....	......	26	....	....	....	24	....	......	....
Port Austin	......	....	15	......	....	....	....	....	....	....	......	....
Thornville	......	....	16	......	....	....	....	....	....	....	6	....
Lansing	......	5	15, 19	......	....	....	....	....	4	....	......	....
Swartz Creek	8	5, 11	15, 20	......	11	....	....	....	....	8, 16	......	....
Ann Arbor	15	5	15	......	13	....	....	....	15	....	7	....
Grand Rapids	......	....	15	......	....	....	....	....	....	....	......	....
Hudson	......	....	....	......	....	24	....	....	....	....	......	....
Birmingham	......	....	15, 31	......	13	....	....	....	....	....	7	....

METEORS.

Aug. 5, two meteors.—*Boyne City.*

Aug. 10, fifteen meteors observed from 9:05 P. M. to 9:40 P. M. Course generally downward, from E. to W.; one upward, from W. to E.—*Lansing.*

Aug. 10, between 9 P. M. and 9:30 P. M., I observed 16 meteors; 14 of them moved in a general southerly direction, 1 from S. to N., and 1 from E. to W.—*Birmingham.*

Oct. 16, meteor seen in N. W.; started at about 60° from the horizon, passed through about 30°, when it exploded with a brilliant light. Its path was visible for 20 seconds after it had exploded.—*Swartz Creek.*

Nov. 10, bright meteor in N. E. at 6:35 P. M. Appeared at about 20° above horizon, and passed downward through an arc of 8 or 10 degrees.—*Ann Arbor.*

Dec. 30, meteor seen; color red; course west; low and very bright.—*Thornville.*

The following is a statement of the days in each month in 1885, which were "all or nearly all sunshine," and the days "all or nearly all cloudy," as reported by the observers at stations in Michigan.

LANSING.

JAN.—Sunny, 4, 7, 8, 10—4 days. Cloudy, 1, 2, 3, 5, 6, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30—26 days.

FEB.—Sunny, 1, 8, 11, 13, 14, 16, 17, 18, 20, 21, 22, 23, 24, 25, 27—15 days. Cloudy, 2, 3, 4, 5, 6, 7, 9, 10, 12, 15, 19, 26—12 days.

Footnotes from page 46.]

§ This line is an average for only the stations from which statements, nearly complete, were received for every month of the year. It does not include the line for Port Austin, Marquette, Boyne City, and Birmingham.

¶ The average for 10 months in 1885 is 57. ** For 11 months, 55. †† For 10 months, 58.

a, b, c. In the columns from January to December, inclusive, the letters a, b, c, etc., stand directly above the numbers from which they refer to the notes below.

a For 92 observations.	b For 91 observations.	c For 89 observations.	d For 88 observations.
e For 87 observations.	f For 85 observations.	g For 83 observations.	h For 80 observations.
i For 76 observations.	j For 73 observations.	k For 71 observations.	l For 70 observations.
m For 67 observations.	n For 63 observations.	o For 62 observations.	p For 57 observations.

MARCH.—Sunny, 2, 8, 10, 11, 15, 16, 17, 19, 20, 21, 22, 23, 25, 28, 29, 31—16 days. Cloudy, 3, 4, 12, 13, 14, 18, 24, 26, 27, 30—10 days.

APRIL.—Sunny, 1, 3, 4, 5, 6, 8, 10, 12, 13, 18, 19, 20, 21, 22, 24, 25, 26, 27, 28, 29—20 days. Cloudy, 2, 7, 9, 11, 14, 15, 16, 17, 23, 30—10 days.

MAY.—Sunny, 1, 2, 4, 11, 12, 13, 14, 15, 16, 17, 20, 21, 24, 25, 26, 27, 28, 31—18 days. Cloudy, 3, 5, 6, 7, 8, 9, 10, 18, 19, 22, 23, 29, 30—13 days.

JUNE.—Sunny, 1, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 27, 29, 30—24 days. Cloudy, 2, 3, 4, 20, 21, 28—6 days.

JULY.—Sunny, 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30—29 days. Cloudy, 6, 31—2 days.

AUG.—Sunny, 5, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 22, 25, 26, 31—15 days. Cloudy, 1, 2, 3, 4, 6, 7, 8, 9, 14, 21, 23, 24, 27, 28, 29, 30—16 days.

SEPT.—Sunny, 1, 2, 3, 5, 6, 7, 11, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27—21 days. Cloudy, 4, 8, 9, 10, 12, 13, 28, 29, 30—9 days.

OCT.—Sunny, 1, 9, 10, 11, 15, 16, 17, 22, 23, 24, 25, 26, 30—13 days. Cloudy, 2, 3, 4, 5, 6, 7, 8, 12, 13, 14, 18, 19, 20, 21, 27, 28, 29, 31—18 days.

NOV.—Sunny, 7, 10, 11, 16, 25, 29—6 days. Cloudy, 1, 2, 3, 4, 5, 6, 8, 9, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 30—24 days.

DEC.—Sunny, 6, 7, 18, 21, 25, 26—6 days. Cloudy, 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 22, 23, 24, 27, 28, 29, 30, 31—25 days.

THORNVILLE.

JAN.—Sunny, 2, 4, 9, 10, 19, 20, 21, 22, 28—9 days. Cloudy, 1, 6, 7, 11, 13, 15, 16, 17, 23, 24, 26, 27, 29—13 days.

FEB.—Sunny, 1, 10, 11, 13, 14, 16, 17, 18, 20, 22, 23, 25—12 days. Cloudy, 2, 3, 4, 6, 7, 8, 9, 15, 19, 26—10 days.

MARCH.—Sunny, 2, 5, 8, 10, 11, 15, 16, 17, 20, 21, 22, 23, 25, 26, 28, 31—16 days. Cloudy, 1, 3, 4, 9, 12, 13, 14, 18, 24, 27—10 days.

APRIL.—Sunny, 1, 4, 5, 6, 18, 19, 20, 21, 22, 23, 25, 26, 28—13 days. Cloudy, 2, 7, 11, 12, 13, 14, 15, 17, 28—9 days.

MAY.—Sunny, 1, 2, 11, 13, 14, 15, 16, 17, 20, 21, 26, 27, 28—13 days. Cloudy, 3, 5, 6, 8, 9, 10, 19, 22, 23, 29, 30—11 days.

JUNE.—Sunny, 1, 2, 6, 9, 10, 11, 12, 14, 17, 18, 19, 23, 24, 29, 30—15 days. Cloudy, 3, 4, 15, 20, 21—5 days.

JULY.—Sunny, 1, 2, 3, 4, 5, 7, 8, 10, 11, 12, 15, 16, 17, 18, 20, 25, 26, 27, 28, 29, 30, 31—22 days. Cloudy days, none.

AUG.—Sunny, 5, 7, 10, 11, 12, 15, 16, 17, 19, 20, 22, 25, 26, 27, 29—15 days. Cloudy, 2, 3, 8, 14, 23, 24—6 days.

SEPT.—Sunny, 2, 5, 6, 7, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29—22 days. Cloudy, 8, 9, 13, 30—4 days.

OCT.—Sunny, 9, 10, 11, 15, 16, 17, 22, 23, 24, 25, 26—11 days. Cloudy, 3, 4, 5, 6, 12, 13, 14, 19, 20, 21, 27, 28, 29, 30—14 days.

NOV.—Sunny days, none. Cloudy, 1, 2, 3, 4, 5, 6, 8, 9, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30—24 days.

DEC.—Sunny, 7, 20, 21, 26—4 days. Cloudy, 1, 2, 4, 6, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 28, 29, 30, 31—22 days.

SWARTZ CREEK.

JAN.—Sunny, 2, 4, 8, 10, 18, 20, 21, 25—8 days. Cloudy, 3, 6, 11, 12, 13, 15, 16, 17, 19, 23, 24, 27, 29, 30, 31—15 days. Fair, 1, 5, 7, 9, 14, 22, 26, 28—8 days.

FEB.—Sunny, 1, 10, 11, 12, 13, 14, 16, 17, 20, 21, 22, 23, 25, 27—14 days. Cloudy, 2, 3, 4, 7, 8, 9, 15, 19, 26, 28—10 days. Fair, 5, 6, 18, 24—4 days.

MARCH.—Sunny, 2, 5, 7, 8, 10, 11, 15, 16, 17, 20, 21, 22, 23, 25, 28, 29, 31—17 days. Cloudy, 1, 3, 4, 6, 12, 13, 14, 18, 27, 30—10 days. Fair, 9, 19, 24, 26—4 days.

APRIL.—Sunny, 1, 3, 4, 5, 6, 10, 20, 21, 22, 23, 25, 26, 27, 29—14 days. Cloudy, 2, 7, 9, 11, 12, 13, 14, 15, 16, 17, 19, 30—12 days. Fair, 8, 18, 24, 28—4 days.

MAY.—Sunny, 1, 2, 7, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 24, 25, 26, 27, 28—18 days. Cloudy, 3, 5, 6, 8, 9, 10, 19, 22, 29, 30—10 days. Fair, 4, 23, 31—3 days.

JUNE.—Sunny, 1, 2, 6, 7, 9, 10, 11, 12, 13, 14, 17, 18, 19, 22, 23, 24, 25, 29, 30—19 days. Cloudy, 3, 4, 20, 21—4 days. Fair, 5, 8, 15, 16, 26, 27, 28—7 days.

JULY.—Sunny, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 25, 26, 27, 28, 29, 30, 31—28 days. Cloudy days, none. Fair, 13, 23, 24—3 days.

AUG.—Sunny, 5, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 25, 26, 30, 31—17 days. Cloudy, 2, 3, 6, 14, 23, 24, 28—7 days. Fair, 1, 4, 7, 8, 9, 27, 29—7 days.

SEPT.—Sunny, 2, 3, 5, 7, 11, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30—21 days. Cloudy, 4, 8, 9, 13—4 days. Fair, 1, 6, 10, 12, 22—5 days.

OCT.—Sunny, 9, 10, 11, 15, 16, 17, 24, 25, 26, 31—10 days. Cloudy, 1, 2, 3, 4, 5, 6, 8, 12, 13, 14, 18, 19, 20, 21, 22, 27, 28, 29, 30—19 days. Fair, 7, 23—2 days.

NOV.—Sunny days, none. Cloudy, 1, 2, 3, 4, 5, 6, 8, 9, 11, 13, 14, 15, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30—23 days. Fair, 7, 10, 12, 16, 17, 19, 29—7 days.

DEC.—Sunny, 3, 18, 26—3 days. Cloudy, 1, 2, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 22, 23, 24, 28, 29, 30, 31—21 days. Fair, 5, 7, 19, 20, 21, 25, 27—7 days.

GRAND HAVEN.

JAN.—Cloudy, 1, 2, 3, 6, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31—24 days.

FEB.—Cloudy, 1, 2, 3, 4—4 days. No record for the rest of the month.

MARCH.—Sunny, 5, 8, 9, 10, 11, 16, 18, 19, 20, 21, 22, 23, 29, 31—14 days. Cloudy, 1, 2, 3, 4, 6, 12, 14, 24, 26, 27, 28, 30—12 days. Fair, 7, 13, 15, 17, 25—5 days.

APRIL.—Sunny, 4—1 day. Cloudy, 2, 7, 14, 15, 17, 20, 30—7 days. For the remaining 22 days, no record given.

MAY.—Sunny, 1, 2, 4, 13, 14, 15, 16, 25, 31—9 days. Cloudy, 17, 19, 29—3 days. No record given for the rest of the month.

JUNE.—Sunny, 1, 9, 10, 17, 18, 22, 23, 28—8 days. Cloudy, 6—1 day. No record given for the rest of the month.

JULY.—Sunny, 1, 2, 3, 11, 26, 27, 30—7 days. Cloudy, 4, 19, 23—3 days. No record given for the rest of the month.

AUG.—Sunny, 9, 10, 15, 16, 19, 25, 26—7 days. Cloudy, 2, 3, 6, 20, 23, 24—6 days. No record for the rest of the month.

SEPT.—Sunny, 5, 14, 16, 18, 24, 25, 26—7 days. Cloudy, 6, 8, 9, 12, 28, 29, 30—7 days. No record given for the rest of the month.

OCT.—Sunny, 9, 10, 11, 15, 16, 17, 30—7 days. Cloudy, 1, 2, 3, 4, 5, 6, 7, 12, 13, 18, 19, 20, 21, 27, 28, 31—16 days.

NOV.—Cloudy, 1, 2, 4, 5, 6, 8, 9, 11, 12, 13, 14, 15, 18, 21, 22, 23, 26, 27, 28, 29, 30—21 days.

DEC.—Cloudy, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 17, 18, 22, 23, 24, 27, 28, 29, 30—20 days.

ESCANABA.

JAN.—Sunny, 13, 18, 21, 27, 28—5 days. Cloudy, 3, 4, 5, 6, 10, 11, 16, 24, 31—9 days.

FEB.—Sunny, 5, 13, 17, 22, 24—5 days. Cloudy, 2, 4, 6, 7, 15, 16, 20, 21, 26, 27, 28—11 days.

MARCH.—Sunny, 7, 8, 16, 20, 21, 22, 24, 28—8 days. Cloudy, 2, 3, 4, 11, 12, 25, 26, 30—8 days.

APRIL.—Sunny, 3, 6, 8, 18, 28—5 days. Cloudy, 2, 10, 11, 12, 14, 15, 17, 19, 22, 23, 25, 26, 27—13 days.

MAY.—Sunny, 2, 13, 14, 15, 22, 23, 24, 26, 27, 31—10 days. Cloudy, 3, 4, 7, 8, 9, 17, 29—7 days.

JUNE.—Sunny, 1, 8, 9, 17, 22, 23, 29, 30—8 days. Cloudy, 4, 11, 13, 14, 20, 25, 26—7 days.

JULY.—Sunny, 1, 2, 3, 4, 7, 11, 26, 28, 29, 30—10 days. Cloudy, 8, 16, 19, 20—4 days.

AUG.—Sunny, 10, 15, 17—3 days. Cloudy, 2, 6, 7, 8, 11, 13, 20, 23, 27, 28, 29, 31—12 days.

SEPT.—Sunny, 5, 10, 16, 18, 23, 24, 26, 27—8 days. Cloudy, 6, 8, 11, 17, 28, 29—6 days.

OCT.—Sunny, 1, 9, 10, 16, 23—5 days. Cloudy, 3, 4, 5, 6, 7, 12, 13, 19, 20, 21, 25, 31—12 days.

NOV.—Cloudy, 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 18, 20, 21, 22, 23, 24, 25, 26, 28, 29—22 days.

DEC.—Sunny, 7—1 day. Cloudy, 2, 4, 5, 9, 10, 13, 15, 17, 18, 20, 21, 23, 24, 27, 28, 30, 31—17 days.

ALPENA.

APRIL.—Sunny, 1, 3, 4, 6, 9, 16, 17, 18, 21, 22, 24, 25, 26, 28, 29, 30—16 days. Cloudy, 2, 5, 7, 8, 10, 11, 12, 13, 14, 15, 19, 20, 23, 27—14 days.

MAY.—Sunny, 2, 4, 7, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 31—20 days. Cloudy, 1, 3, 5, 6, 8, 9, 10, 18, 19, 29, 30—11 days.

JUNE.—Sunny, 1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27, 29, 30—24 days. Cloudy, 4, 7, 13, 14, 20, 28—6 days.

JULY.—Sunny, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31—28 days. Cloudy, 19, 20, 23—3 days.

AUG.—Sunny, 5, 7, 8, 9, 10, 11, 12, 14, 15, 16, 18, 19, 22, 24, 25, 26, 30—17 days. Cloudy, 1, 2, 3, 4, 6, 13, 17, 20, 21, 23, 27, 28, 29, 31—14 days.

SEPT.—Sunny, 1, 2, 3, 5, 6, 7, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 28, 30—24 days. Cloudy, 4, 8, 9, 13, 23, 29—6 days.

OCT.—Sunny, 1, 4, 9, 10, 11, 14, 15, 16, 17, 18, 20, 23, 24, 27, 30—15 days. Cloudy, 2, 3, 5, 6, 7, 8, 12, 13, 19. 21, 22, 25, 26, 28, 29, 31—16 days.

NOV.—Sunny, 7, 10, 15, 19, 27—5 days. Cloudy, 1, 2, 3, 4, 5, 6, 8, 9, 11, 12, 13, 14, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 28, 29, 30—25 days.

DEC.—Sunny, 7, 8, 20, 21, 25, 26—6 days. Cloudy, 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 27, 28, 29, 30, 31—25 days.

BIRMINGHAM.

MARCH.—Sunny, 8, 10, 11, 16, 17, 20, 21, 22, 23, 24, 25, 26, 28, 29, 31—15 days. Cloudy, 1, 2, 3, 4, 5, 6, 7, 9, 12, 13, 14, 15, 18, 19, 27, 30—16 days.

EXHIBIT 21.—*Dates of Solar and Lunar Halos,*

Line Number.	Stations.	Dates of Halos Recorded,									
		January.		February.		March.		April.		May.	
		Solar.	Lunar.	Solar.	Lunar.	Solar.	Lunar.	Solar.	Lunar.	Solar.	Lunar.
1	Marquette										
2	Manistique		23,24,26			23,16	23				21
3	Escanaba	1,4,5,8	2,3,22	10,11		17,23		16,17	23,25,26	2,3,6,12	21,28
4		10,14,17	23,24,30			29,30		25,27		21,28	
5		22,25									
6	Boyne City					7,8,18					
7	Mackinaw City					6,13,17	23,29				
8						23,25					
9	Alpena		26,27		27	17,23	29	17	24,25	3	20
10											
11	Grand Haven		4,10,26	19,28	23,28	7,22,23	19,27	4,25	1,26,27	22	20,21
12			27,29				29,31				27,28
13	Port Austin		27				23	11,17,10		12	
14	Port Huron										
15	Thornville									27	23
16	Ionia		22		20		27				
17	Lansing			8		17	27	10		27	
18	Swartz Creek		1,3,4,7		24	5,28	23,27	10,25	27	27	20
19			8,25,27				29,31				
20	Ann Arbor	5,14	26			25,27	23	1,5,9,14	27	12,19,21	
21		18,19				28,31		17,18,25			
22	Birmingham								27	12,27	

APRIL.—Sunny, 1, 3, 4, 5, 6, 20, 21, 22, 23, 26, 27, 28, 29—13 days. Cloudy, 2, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 24, 25, 30—17 days.

MAY.—Sunny, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 23, 27—12 days. Cloudy, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 19, 22, 24, 25, 26, 28, 29, 30, 31—19 days.

JUNE.—Sunny, 1, 2, 6, 8, 9, 10, 11, 12, 14, 17, 18, 19, 22, 23, 24, 29, 30—17 days. Cloudy, 3, 4, 5, 7, 13, 15, 16, 20, 21, 25, 26, 27, 28—13 days.

JULY.—Sunny, 1, 2, 3, 4, 5, 7, 8, 10, 11, 15—10 days. Cloudy, 6, 9, 12, 13, 14—5 days.

Recorded on the Monthly Registers in 1885.

Months in 1885.														
June.		July.		August.		September.		October.		November.		December.		Line Number.
Solar.	Lunar.	Solar.	Lunar.	Solar.	Lunar.	Solar.	Lunar.	Solar.	Lunar.	Solar.	Lunar.	Solar.	Lunar.	
......	...	......	......	2,3	......	......	17,27	......	25	......	16,19	......	16,19,22	1
......	...	12	......	......	......	......	......	12	14,18	......	16	......	......	2
4,7	20	8,19	......	2,22,27	23,24,26	13	17,19	10,11,12	18,25	6,11	16,19	8,12,13	14,20,21	3
11,24	...	......	......	......	......	......	......	14,27	......	19,24	......	20,21	......	4
......	...	......	......	......	......	......	......	......	......	......	......	......	......	5
......	...	......	19	......	......	......	......	......	......	......	......	......	......	6
......	...	......	......	......	23,26	......	......	......	......	......	19	......	21	7
......	...	......	......	......	......	......	......	......	......	......	......	......	......	8
......	27	......	......	2,8	......	......	19	12	18,24	......	16,17	......	21	9
......	...	......	......	......	......	......	......	......	......	......	19,27	......	......	10
......	18	......	24	20	20	......	26,27	10,18	26	4	16	......	20	11
......	...	......	......	......	......	......	......	......	......	......	......	......	......	12
......	...	......	......	......	......	......	......	......	......	......	16	......	......	13
......	...	......	......	......	......	12,28	......	12	24	......	......	......	......	14
......	19	......	......	......	......	......	......	......	......	......	......	......	......	15
......	...	......	......	......	......	......	......	......	......	......	......	......	......	16
......	15	......	24	......	20	......	......	12	......	11,17	16	......	18,19	17
......	...	14	......	......	......	6	19	......	......	10	16,20	25	......	18
......	...	......	......	......	......	......	......	......	......	......	......	......	......	19
2	...	7,31	23,24	......	......	......	......	......	......	......	......	......	......	20
......	...	......	......	......	......	......	......	......	......	......	......	......	......	21
21	...	......	......	......	......	......	......	......	......	......	......	......	......	22

AUG.—Sunny, 10, 11, 12, 15, 16, 17, 18, 19, 20, 21, 22, 25, 26, 31—14 days. Cloudy, 1, 2, 3, 4, 5, 6, 7, 8, 9, 13, 14, 23, 24, 27, 28, 29, 30—17 days.

SEPT.—Sunny, 1, 2, 3, 5, 6, 7, 11, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 29—21 days. Cloudy, 4, 8, 9, 10, 12, 13, 22, 28, 30—9 days.

OCT.—Sunny, 1, 9, 10, 11, 15, 16, 17, 20, 23, 24, 25 26—12 days. Cloudy, 2, 3, 4, 5, 6, 7, 8, 12, 13, 14, 18, 19, 21, 22, 27, 28, 29, 30—18 days.

DEC.—Sunny, 3, 7, 20, 21, 26—5 days. Cloudy 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 27, 28, 29, 30, 31—26 days.

TABLE VII.—*Inches of Rain and Melted Snow for the Year and for each Month of the Year 1885, at 17 Stations in Michigan,—as compiled from Daily Observations made by Observers* for the State Board of Health, and for the U. S. Signal Service.*

Stations in Michigan.* (Those of the U. S. Signal Service in Italics.)	Divisions of the State.†	Inches of Rain and Melted Snow.													
		Year.		Months, 1885.											
		Norm. ‡	1885.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 17 Stat'ns§	....	......	35.82	2.90	1.83	1.29	2.42	2.75	3.79	3.00	5.72	2.93	3.35	2.90	2.94
Marquette	U. P.	......	¶	.....	.....	2.14	1.96	3.19	3.34	1.85	2.47	1.00	2.91	4.10	1.87
Manistique	U. P.	35.40^{2}	30.83	2.05	2.13	3.28	2.19	2.28	2.23	1.02	5.28	0.94	2.53	3.70	3.20
Escanaba	U. P.	35.57^{14}	31.27	1.31	0.91	2.21	3.15	3.59	1.92	2.11	5.25	1.69	2.35	3.41	3.37
Traverse City	N. W.	42.45^{4}	38.86	4.87	1.78	2.27	3.18	3.02	1.69	2.40	6.95	2.21	2.64	2.85	5.00
Boyne City	N.	......	‖	3.27	.....	2.33	2.77	4.03	1.19	3.58	5.52	1.66	3.82	2.28	0.25
Mackinaw City	N.	34.35^{2}	28.49	4.39	3.59	1.22	1.88	2.53	1.88	3.55	2.78	0.69	2.04	2.21	1.73
Alpena	N. E.	37.69^{13}	34.35	2.09	1.61	1.24	2.28	2.18	1.74	2.51	7.18	3.71	4.14	2.56	3.11
Grand Haven	W.	40.97^{10}	35.40	3.20	1.54	1.02	1.38	1.17	5.63	3.12	4.78	4.39	4.15	1.63	3.39
Muskegon	W.	......	**	.....	.....	.....	.....	.....	4.01	3.99	6.24	4.56	4.55	2.12	.....
Reed City	W.	39.81^{7}	38.40	2.20	3.02	1.57	2.85	1.70	4.68	2.52	5.39	4.97	3.65	2.74	3.11
Port Huron	B. & E.	34.47^{11}	33.75	2.87	3.38	0.71	1.26	3.75	5.29	3.00	3.28	2.06	2.52	3.10	2.53
Thornville	B. & E.	35.14^{9}	37.12	2.63	1.53	1.25	2.61	3.05	4.90	3.10	5.40	2.64	3.26	4.61	2.14
Agr'l College	C.	32.47^{22}	35.00	2.70	0.73	0.58	2.47	2.30	6.01	2.52	5.82	3.75	3.08	2.90	2.14
Ionia	C.	......	29.11	3.15	2.19	1.21	2.04	0.66	3.31	0.87	4.30	4.68	1.85	4.15	0.70
Lansing	C.	38.97^{6}	34.51	1.59	0.45	0.60	2.38	1.85	5.88	2.04	6.75	3.46	3.60	3.05	2.86
Swartz Creek	C.	35.35^{9}	35.8	2.99	1.41	0.95	2.00	2.86	5.18	2.06	3.54	3.80	4.49	3.19	3.42
Ann Arbor	S. C.	......	35.14	2.54	1.40	1.28	3.47	3.72	3.94	2.05	6.02	2.69	3.43	1.74	2.86
Kalamazoo	S. C.	40.16^{9}	40.48	4.58	2.84	1.04	2.25	1.39	3.48	2.28	8.94	3.56	4.38	3.11	2.63
Parkville	S. C.	......	53.99	4.26	2.50	1.06	3.15	3.47	2.18	10 48	10.31	4.33	5.06	3.43	3.76
Tecumseh	S. C.	39.91^{6}	37.14	3.12	1.10	0.95	2.88	4.19	4.48	3.46	4.57	3.31	3.93	2.80	2.35
Birmingham	S. E.	......	††	.....	.....	0.89	2.91	3.56	3.03	4.56	5.14	2.11	2.79	3.25	2.62
Detroit	S. E.	34.99^{14}	28.24	1.89	1.26	0.66	1.83	3.65	3.36	2.83	5.05	1.54	1.68	2.19	2.30

* The names of observers, their places of observation, and the counties in which these places are situated, are stated in Exhibit 1, page 9.

† The names of divisions, and the counties in each are stated in Exhibit I, in a paper which follows, on weekly reports of diseases.

‡ Numbers in this column state the average annual rainfall for periods of years ending in each case with Dec. 31, 1885. The small figures above and at the right of numbers which state the rain-fall, denote the number of years included in the average.

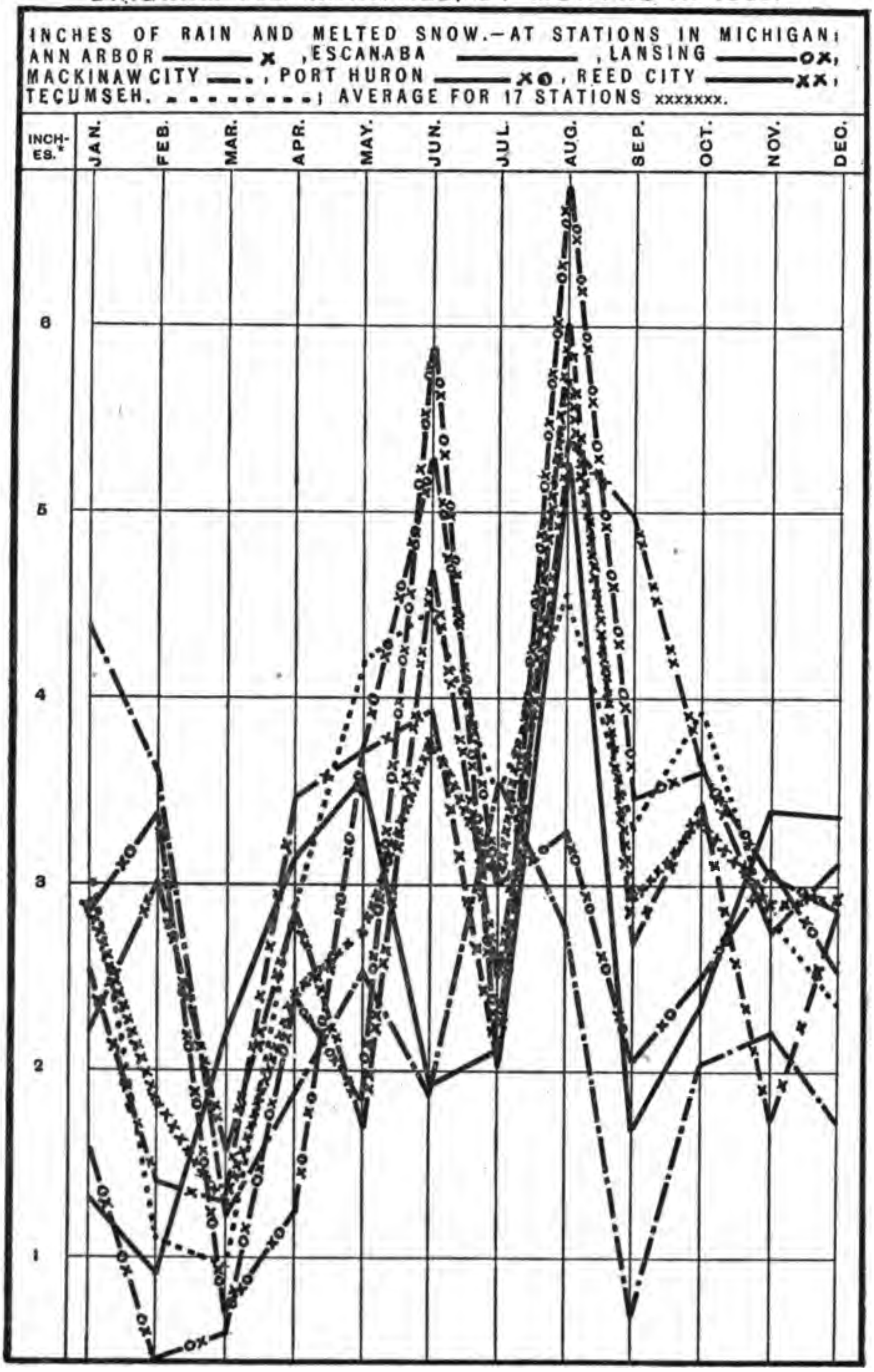
§ This line is an average for only the stations for which statements, nearly complete, are given for every month of the year. It does not include Marquette, Boyne City, Muskegon, Ionia, or Birmingham.

¶ The total rain-fall for 10 months in 1885 is 24.83 inches. ‖ For 11 months, 30.70. ** For 6 months, 25.47. †† For 10 months 31.46.

NOTE.—Computations of amount of rain-fall were furnished by the observers at Escanaba, Mackinaw City, Alpena, Grand Haven, Port Huron, Swartz Creek, Ionia except for Sept., Oct., Nov., and Dec., Ann Arbor, except for Sept., Manistique, except for May and July, and Detroit for the year; at Marquette, except for Jan. and Feb. All other computations in Table VII. were made in the offices of the Secretary of State and the State Board of Health.

The lines for 7 representative stations in Table VII. are graphically represented in Diagram VII., page 55.

DIAGRAM VII.—RAINFALL, BY MONTHS IN 1885.



*SCALE, 1 IN. RAINFALL TO ONE IN. VERTICALLY.

H. B. T. DEL. DES. BY H. B. B.

EXHIBIT 22.—*Inches of Rain and Melted Snow by Years and Months, in 1885, compared with Annual and Monthly Average for 1884, and for the 9 Years, 1877–85. These Averages are for Groups of several Stations in Michigan.**

Years, Etc.	Inches of Rain and Melted Snow.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 9 yrs, 1877–85*	37.73	2.02	2.63	2.50	2.67	3.50	4.43	3.86	3.50	3.37	3.80	3.33	2.83
1884 (20 stations*)	30.85	2.06	3.52	2.42	2.33	3.21	2.95	3.16	2.05	3.49	4.61	2.21	4.95
1885 (17 stations*)	35.82	2.90	1.83	1.29	2.42	2.75	3.79	3.00	5.72	2.93	3.35	2.90	2.94
In 1885 **Greater** than Av. for 9 y'rs—1877–85	......	0.88	......	......	......	0.25	......	......	2.22	......	......	......	0.11
In 1885 **Less** than Av. for 9 y'rs—1877–85	1.91	......	0.80	1.21	0.25	......	0.64	0.86	......	0.44	0.45	0.43	......
In 1885 **Greater** than in 1884	4.97	0.84	......	......	0.09	......	0.84	......	3.67	......	......	0.69	......
In 1885 **Less** than in 1884	......	......	1.69	1.13	......	0.46	......	0.16	......	0.56	1.26	......	2.01

* Thornville, Kalamazoo, Detroit for 1877-85; Mendon for 1877-8 and 1880-2; Tecumseh for 1877-8 and 1880-5; Niles for 1878-81; Nirvana, Coldwater, Woodmere Cemetery (near Detroit) for 1877-9; Agricultural College for 1877-8 and 1881-5; Otisville for 1878-80, 1882; Marquette,1879-84: Alpena, Grand Haven, Port Huron for 1879-85; Battle Creek, 1877-8, 1884; Benton Harbor for 1877-8; Escanaba, Lansing for 1880-5; Washington for 1880-3; Fife Lake, Ypsilanti for 1877; Harrisville for 1881-2; Reed City for 1881-5; Winfield, 1881-3; Ann Arbor for 1881-2, 1885; Marshall for 1881-4; Hudson and Mallory Lake for 1881; Traverse City for 1882-5; Hastings for 1882; Hillsdale for 1882-4.; Parkville for 1882-3, 1885; Ionia for 1883-4; Manistique, Mackinaw City, Swartz Creek for 1884-5.

EXHIBIT 23.—*Comparison of the Rainfall during the Year and during each Month of the Year 1885, with that for the Year 1884; and with the Average for the 21 Years, 1864–84. Observations made by Prof. R. C. Kedzie, at the State Agricultural College, near Lansing, Michigan.*

Years, Etc.	Inches of Rain and Melted Snow.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 21 years, 1864-84	32.35	1.70	2.04	2.68	2.50	3.17	4.29	3.64	2.67	2.88	2.67	2.23	1.91
1884	36.28	1.23	3.69	3.67	1.95	3.95	2.83	2.60	1.30	3.34	5.73	1.84	4.15
1885	35.00	2.70	0.73	0.58	2.47	2.30	6.01	2.52	5.82	3.75	3.08	2.90	2.14
In 1885 **Greater** than Av. for 21 y'rs—1864–84	2.65	1.00	......	......	......	......	1.72	......	3.15	0.87	0.41	0.67	0.23
In 1885 **Less** than Av. for 21 y'rs—1864-84	......	......	1.31	2.10	0.03	0.87	......	1.12	......	......	......	......	......
In 1885 **Greater** than in 1884	......	1.47	......	......	0.52	......	3.18	......	4.52	0.41	......	1.06	......
In 1885 **Less** than in 1884	1.28	......	2.96	3.09	......	1.65	......	0.08	......	......	2.65	......	2.01

OBSERVATIONS FOR OZONE AT LANSING.

Since July 1, 1884, the observations for ozone at Lansing have been taken at the new shelter for meteorological instruments in the southwest part of the Capitol yard. Previous to July 1, 1884, the observations had been taken at the office window. Exhibit E, page 60, of the Report for 1885, shows that the average for the month of July, 1884, is greater at each observation—7 A. M. to 2 P. M., 2 P. M. to 9 P. M., and 9 P. M. to 7 A. M. at the shelter for instruments than at the office window. Possibly this fact should be taken into consideration into studying ozone at Lansing through a long period of years.

EXHIBIT 24.—*Average Amount of Atmospheric Ozone (Day) by Year and Months, in 1885, compared with Annual and Monthly Average for 1884, and for the nine years, 1877–1885. These Averages are for Groups of several Stations in Michigan.**

Years, Etc.	Ozone by Day.—Degree of Coloration of Test Paper.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 9 years—1877–85*	3.07	3.38	3.51	3.51	3.25	3.10	2.89	2.71	2.86	2.71	2.74	2.98	3.13
1884 (20 stations*)	2.75	3.41	3.36	3.03	2.90	2.91	2.64	2.52	2.62	2.28	2.33	2.40	2.62
1885 (16 stations*)	2.92	2.88	3.05	3.31	3.21	2.96	2.61	2.47	3.07	2.72	3.03	2.87	2.92
In 1885 **Greater** than Av. for 9 yrs, '77-85	......	......	......	......	......	......	......	......	0.21	0.01	0.29	......	......
In 1885 **Less** than Av. for 9 yrs, 1877–85	0.15	0.50	0.46	0.20	0.04	0.14	0.28	0.24	......	......	......	0.11	0.21
In 1885 **Greater** than in 1884	0.17	......	......	0.28	0.31	0.05	......	......	0.45	0.44	0.70	0.47	0.30
In 1885 **Less** than in 1884	......	0.53	0.31	......	......	......	0.03	0.05	......	......	......	......	......

* Thornville, Kalamazoo, Tecumseh for 1877–85; Mendon for 1877–83; Battle Creek for 1877–80 and 1882-4; Niles for 1878-81; Nirvana for 1877–9; Coldwater, Agricultural College for 1877–8, 1880; Otisville for 1878–80, 1882; Alpena, Lansing for 1879–85; Washington for 1879–83; Petoskey, Woodmere Cemetery (near Detroit) for 1878–79; Marquette for 1880-1 and 1883-4; Grand Haven for 1880-4; Ann Arbor for 1880-5; Fife Lake, Ypsilanti for 1877; Ionia 1880, 1883-4; Adrian for 1880; Hudson and Mallory Lake for 1881; Escanaba, Reed City, Port Huron, Marshall for 1881-5; Harrisville for 1881-2, 1885; Traverse City for 1882-5; Hastings for 1882; Hillsdale for 1882-4; Parkville for 1882; Port Austin for 1883-5; Winfield for 1883; Manistique, Mackinaw City, Swartz Creek for 1884-5.

EXHIBIT 25.—*Average Amount of Atmospheric Ozone (Night), by Year and Months in 1885, compared with Annual and Monthly Average for 1884 and for the nine Years, 1877–1885. These Averages are for Groups of several Stations in Michigan.**

Years, Etc.	Ozone by Night.—Degree of Coloration of Test Paper.												
	Annual Av.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 9 yrs, 1877–85*	3.21	3.91	4.05	4.12	3.59	3.32	2.94	2.51	2.40	2.44	2.93	3.32	3.55
1884 (20 stations*)	3.11	3.98	4.30	3.73	3.09	3.28	2.70	2.62	2.62	2.42	2.74	2.80	3.07
1885 (16 stations*)	3.47	3.49	3.65	3.75	3.96	3.68	3.20	3.00	3.41	3.14	3.43	3.38	3.50
In 1885 **Greater** than Av. for 9 yrs, 1877–85	0.26	......	......	......	0.37	0.36	0.26	0.49	1.01	0.70	0.50	0.06	......
In 1885 **Less** than Av. for 9 yrs, 1877–85	......	0.42	0.40	0.37	......	......	......	......	......	......	......	......	.05
In 1885 **Greater** than in 1884	0.36	......	......	0.02	0.87	0.40	0.50	0.38	0.79	0.72	0.69	0.58	0.43
In 1885 **Less** than in 1884	......	0.49	0.65	......	......	......	......	......	......	......	......	......	......

* The stations represented in Exhibit 25 are the same as those represented in Exhibit 24, relative to day ozone, and named in the foot-note of that Exhibit.

TABLE VIII.—*Relative Amount of Ozone in the Atmosphere, by Day, during Year, and during each Month of the Year 1885, at 16 Stations in Michigan,—as Indicated by Averages of Observations made daily by Exposing Test-paper prepared according to Schönbein's formula, from 7 A. M. to 2 P. M.—Recorded according to a scale of 10 Degrees of Coloration of the Test-paper (greatest coloration by ozone equals 10) by Observers for the State Board of Health, and for the U. S. Signal Service.**

Stations in Michigan.† (Those of the U. S. Signal service in Italics.)	Divisions of the State.†	Degrees of Coloration of Test-paper—Day Observations.													
		Year.		Months, 1885.											
		Norm. ‡	1885.	Jan.	Feb.	Mar.	Apr.	May.	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 16 Stat'ns§	....	......	2.92	2.88	3.05	3.31	3.21	2.96	2.61	2.47	3.07	2.72	3.03	2.87	2.92
Marquette	U. P.	......	¶	.....	.....	.....	.....	[b]2.00	2.00	1.84	[c]2.29	[c]3.96	[b]0.90	.....	[c]1.25
Manistique	U. P.	......	2.71	2.39	2.61	[a]3.10	3.60	2.81	3.13	2.13	2.52	[c]2.36	2.81	2.93	[a]2.13
Escanaba	U. P.	3.26[5]	3.02	3.50	2.90	[a]3.80	4.50	3.20	2.80	2.30	3.10	2.40	2.60	2.30	2.80
Traverse City	N. W.	2.65[4]	2.62	2.90	3.00	2.94	2.83	3.19	2.03	1.29	2.03	2.17	3.03	3.07	3.00
Boyne City	N.	......	‖	3.35	.....	3.10	2.83	2.87	2.27	2.58	3.41	3.07	2.97	3.00	2.84
Mackinaw City ...	N.	......	3.04	2.40	2.61	4.20	3.90	2.60	1.90	2.84	3.29	3.50	2.39	2.37	4.50
Alpena	N. E.	3.33[7]	3.39	2.81	2.86	3.10	3.50	3.45	2.93	3.26	3.61	2.70	4.03	4.97	3.42
Harrisville	N. E.	......	4.37	3.68	3.25	3.61	4.20	4.23	4.50	4.48	4.90	4.93	4.52	5.17	4.97
Grand Haven	W.	......	**	3.80	3.60	4.40	4.70	4.40	4.10	3.10	.....	4.90	5.30	4.60	4.00
Reed City	W.	3.37[7]	2.77	[e]2.82	2.82	2.32	2.37	[b]3.14	2.37	2.26	3.58	2.43	3.13	2.87	3.16
Port Austin	B. & E.	2.74[3]	2.67	[a]3.07	[d]3.56	3.03	[e]2.56	[b]2.14	2.30	1.74	[c]2.54	2.10	[h]2.82	3.13	3.03
Port Huron	B. & E.	2.80[5]	2.76	2.61	2.64	2.87	2.30	2.74	2.60	2.30	3.61	3.30	3.20	2.40	2.50
Thornville	B. & E.	2.69[9]	2.48	3.10	3.07	3.13	2.47	2.23	1.87	1.94	2.36	1.87	2.61	2.60	2.55
Ionia	C.	......	2.19	0.93	2.14	2.97	2.60	2.00	2.33	1.61	2.00	[b]3.10	[b]1.55	[g]3.35	[i]1.72
Lansing	C.	3.29[7]	2.83	2.61	2.50	3.19	2.57	2.52	2.57	2.65	3.77	3.23	3.35	2.33	2.65
Swartz Creek	C.	......	3.20	[a]3.12	3.61	[a]4.18	3.53	3.52	2.90	2.65	[a]2.93	2.97	3.39	2.62	2.95
Ann Arbor	S. C.	2.53[6]	2.86	2.20	3.29	3.32	3.70	3.58	3.03	2.50	2.70	2.87	[d]2.60	2.07	[a]2.47
Battle Creek	S. C.	......	1.49	1.31	1.68	1.08	1.20	1.79	1.43	1.54	0.82	1.93	1.97	1.47	[a]1.62
Kalamazoo	S. C.	2.69[9]	2.43	2.68	2.82	2.87	3.00	2.81	2.07	2.16	2.42	1.77	2.55	[b]1.86	2.19
Marshall	S. C.	3.81[5]	3.47	3.55	3.96	4.03	3.53	3.39	2.93	3.77	3.90	3.57	3.17	3.07	2.77
Tecumseh	S. C.	3.19[9]	2.17	[a]2.70	3.32	3.29	2.77	[d]1.74	[d]1.85	1.23	1.90	[e]1.28	2.29	[f]2.08	1.58
Birmingham	S. E.	......	††	.....	.....	4.23	2.03	2.00	2.43	1.65	2.97	[b]2.72	2.74	3.10	2.10

NOTE.—The computations were furnished by the observers at Ann Arbor for the year; at Mackinaw City for Jan. to May. and Sept. and Dec.; at Ionia, Jan. to Apr. inclusive; at Escanaba, Jan. to June and Aug. to Dec.; at Grand Haven, Jan. to July and Sept. to Dec.; at Port Huron for July and Sept. to Dec. All other computations for Table VIII were made in the office of the State Board of Health.

* At the stations of the U. S. signal service the observations were made at 7 A. M., 3 P. M. and 11 P. M., 75th Meridian time. The corresponding local time for each of these stations is stated in the (*) foot-note to Table I, page 26.

† The names of observers, their places of observation, and the counties in which these places are situated, are stated in Exhibit 1, page 9. The full names of the divisions and the counties in each division are stated in Exhibit I in a paper which follows, on weekly reports of sickness.

‡ Numbers in this column state the average annual relative amount of ozone by day for periods of years ending in each case with December 31, 1885. The small figures above and at the right of numbers which state the average denote the number of years included in the average.

§ This line is an average for only the stations from which statements nearly complete were received for every month in the year. It does not include Marquette, Boyne City, Grand Haven, Battle Creek, Birmingham or Ionia.

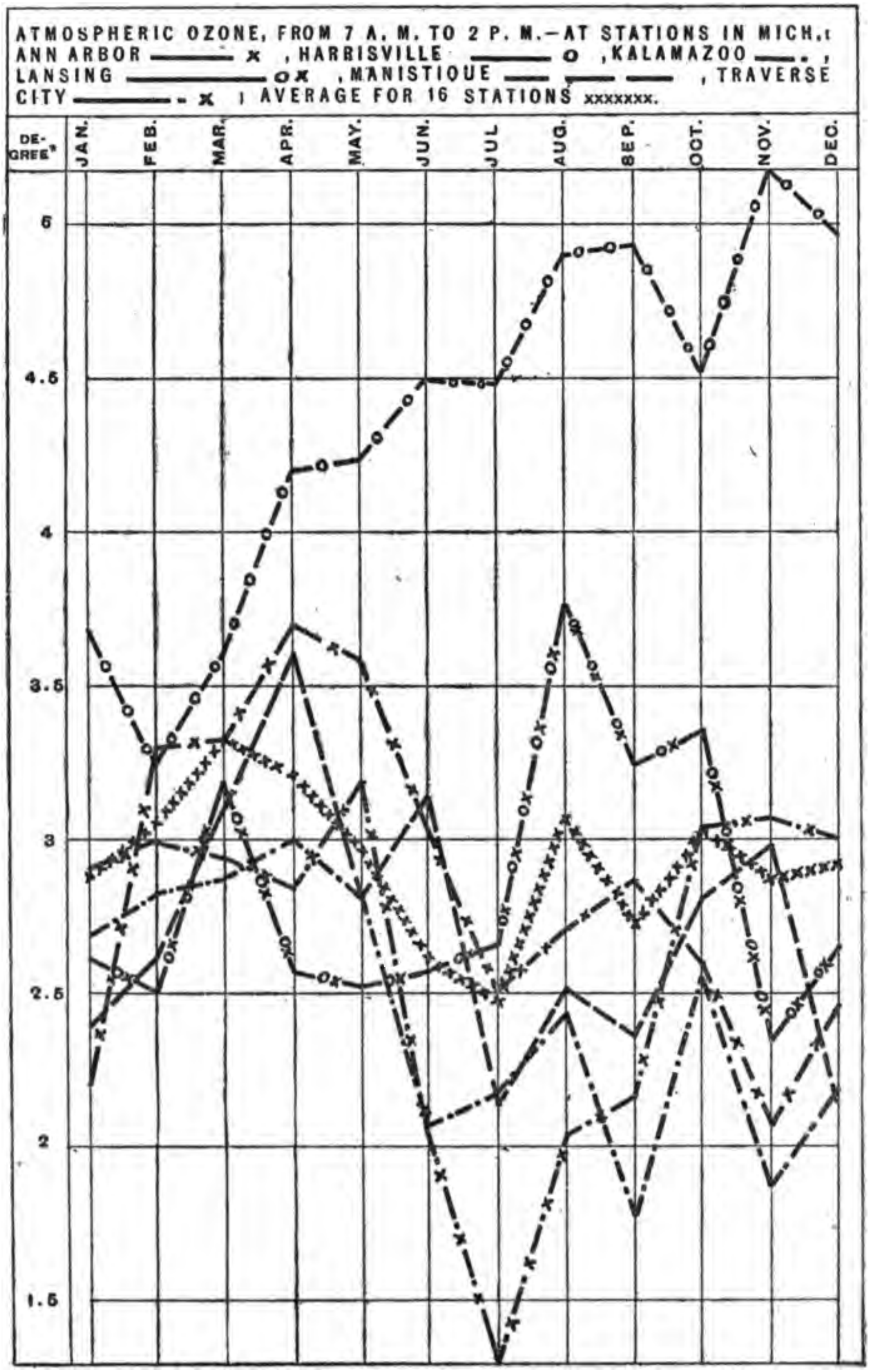
¶ The average for 7 months in 1885 is 2.03. ‖ For 11 months, 2.94. ** For 11 months, 4.26. †† For 10 months, 2.59.

a, b, c. In the columns from January to December, inclusive, the letters a, b, c, etc., stand directly above the numbers from which they refer to the notes below.

[a] For 30 days. [b] For 29 days. [c] For 28 days. [d] For 27 days. [e] For 25 days. [f] For 24 days. [g] For 23 days. [h] For 22 days. [i] For 18 days.

Six lines in this table are graphically represented in Diagram VIII., page 59.

DIAGRAM VIII.—OZONE, AV. BY DAY, MONTHS IN 1885.



*SCALE. 1 DEG. OF COLORATION (ON SCALE OF 10 DEGS.) TO 1.64 IN. VERTICALLY.
H. B. T., DEL.   DES. BY H. B. B.

TABLE IX.—*Relative amount of Ozone in the Atmosphere at Night, during the Year, and during each Month of the Year 1885, at 16 Stations in Michigan,—as indicated by Averages of Observations made Nightly by Exposing Test-paper, prepared according to Schönbein's formula, from 9 P. M. to 7 A. M.,—Recorded according to a Scale of 10 Degrees of Coloration of the Test-paper (greatest coloration by Ozone equals 10), by Observers for the State Board of Health, and for the U. S. Signal Service.**

Stations in Michigan.† (Those of the U. S. Signal Service in Italics.)	Divisions of the State.†	Degrees of Coloration of Test-paper—Night Observations.													
		Year.		Months, 1885.											
		Norm. ‡	1885.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 16 Stat'ns§	....	......	3.47	3.49	3.65	3.75	3.96	3.68	3.20	3.00	3.41	3.14	3.43	3.38	3.50
Marquette	U. P.	......	¶	.....	.....	.....	.....	[b] 2.55	[e] 3.61	[a] 1.37	[a] 3.77	[b] 1.34	[c] 3.68	.....	[a] 2.57
Manistique	U. P.	3.87 [9]	3.53	3.81	4.11	4.16	4.43	[a] 3.40	[b] 3.52	2.65	3.45	3.03	3.74	3.50	2.52
Escanaba	U. P.	3.22 [5]	3.63	4.10	3.80	[a] 4.00	5.00	3.80	3.60	2.80	3.50	3.40	3.30	2.90	3.30
Traverse City	N. W.	2.78 [4]	2.71	3.03	3.25	3.19	3.43	3.32	1.90	0.94	1.87	1.77	3.16	3.37	3.32
Boyne City	N.	......	‖	3.77	.....	3.39	3.63	3.06	2.40	2.45	3.20	2.63	3.35	3.20	3.23
Mackinaw City	N.	3.17 [9]	3.23	2.90	2.54	3.80	4.80	2.60	2.60	2.74	3.45	3.60	2.74	2.70	4.30
Alpena	N. E.	3.71 [7]	5.05	4.39	4.89	4.32	5.37	4.65	3.87	5.19	5.97	5.17	5.48	5.97	5.29
Harrisville	N. E.	......	5.02	4.52	4.29	4.97	5.73	5.55	6.17	6.10	6.23	5.90	3.39	6.13	6.06
Grand Haven	W.	......	††	4.00	3.90	4.90	5.20	3.40	4.80	4.00	.....	4.80	6.90	4.20	3.10
Reed City	W.	3.48 [7]	3.52	[a] 4.47	4.04	3.48	3.53	[b] 3.21	3.17	2.87	3.29	2.53	3.71	3.63	4.29
Port Austin	B. & E.	3.84 [3]	3.85	[b] 3.97	[d] 5.00	4.19	[e] 3.64	3.72	3.73	[a] 3.47	[b] 3.59	3.20	[g] 3.73	4.10	3.81
Port Huron	B. & E.	2.87 [5]	2.96	2.74	2.75	2.68	2.40	3.48	2.93	2.80	3.29	3.40	3.60	2.60	2.90
Thornville	B. & E.	3.27 [9]	3.41	3.58	4.11	3.68	3.60	3.74	2.80	2.58	2.77	3.04	3.39	3.73	3.87
Ionia	C.	2.21	2.21	1.38	1.64	2.58	2.83	2.16	2.97	1.81	2.03	[d] 2.03	[d] 2.19	[f] 3.00	[b] 1.86
Lansing	C.	3.77 [7]	3.07	2.74	2.54	2.90	2.73	3.48	3.00	3.10	3.84	3.47	3.74	2.47	2.77
Swartz Creek	C.	3.81 [2]	3.66	3.34	3.98	4.50	4.65	4.39	[b] 3.52	2.90	[a] 3.05	2.85	[b] 3.93	3.08	[a] 3.68
Ann Arbor	S. C.	2.56 [6]	2.93	[a] 2.90	3.14	3.71	[b] 4.10	4.02	2.70	2.40	2.40	[b] 2.34	2.71	[b] 2.34	2.35
Battle Creek	S. C.	1.44	1.44	1.61	1.52	1.85	1.62	1.42	1.45	1.23	1.28	1.40	1.55	0.88	[a] 1.52
Kalamazoo	S. C.	3.09 [9]	2.84	2.97	3.00	3.29	2.93	3.23	3.03	2.58	2.94	2.03	3.19	[b] 2.21	2.65
Marshall	S. C.	3.22 [5]	3.18	3.32	3.29	3.58	4.03	3.68	2.93	3.16	3.45	2 87	2.73	2.50	2.58
Tecumseh	S. C.	3.17 [9]	2.51	[a] 3.07	3.68	3.60	[e] 3.00	[d] 2.61	1.80	1.77	1.52	1.71	2.26	[f] 2.83	2.26
Birmingham	S. E.	**	......	.....	.....	4.58	3.13	2.77	3.03	1.52	3.16	3.27	3.58	3.13	2.61

NOTE.—The computations were furnished by the observers at Ann Arbor for the year; at Mackinaw City, Jan. to May, and Sept. and Dec.; at Ionia, Jan. to April; at Escanaba, Jan. to June, and Aug. to Dec.; at Grand Haven, Jan. to July, and Sept. to Dec.; at Port Huron for July, and Sept. to Dec. All other computations in Table IX. were made at the office of the State Board of Health.

* At the U. S. Signal Service Stations for the year 1885, the observations were made at 7 A. M., 3 P. M., and 11 P. M., 75th Meridian time. The corresponding local time for each of these stations is stated in star (*) footnote to Table I., page 26.

† The names of observers, their places of observation, and the counties in which these places are situated, are stated in Exhibit 1, page 9. The full names of divisions, and the counties in each division, are stated in Exhibit I, in a paper which follows, on weekly reports of sickness.

‡ Numbers in this column state the average annual relative amount of ozone by night for periods of years ending in each case with Dec. 31, 1885. The small figures above and at the right of numbers which state the average, denote the number of years included in the average.

§ This line is an average for only the stations from which statements, nearly complete, were received for every month in the year. It does not include Marquette, Boyne City, Grand Haven, Ionia, Battle Creek, or Birmingham.

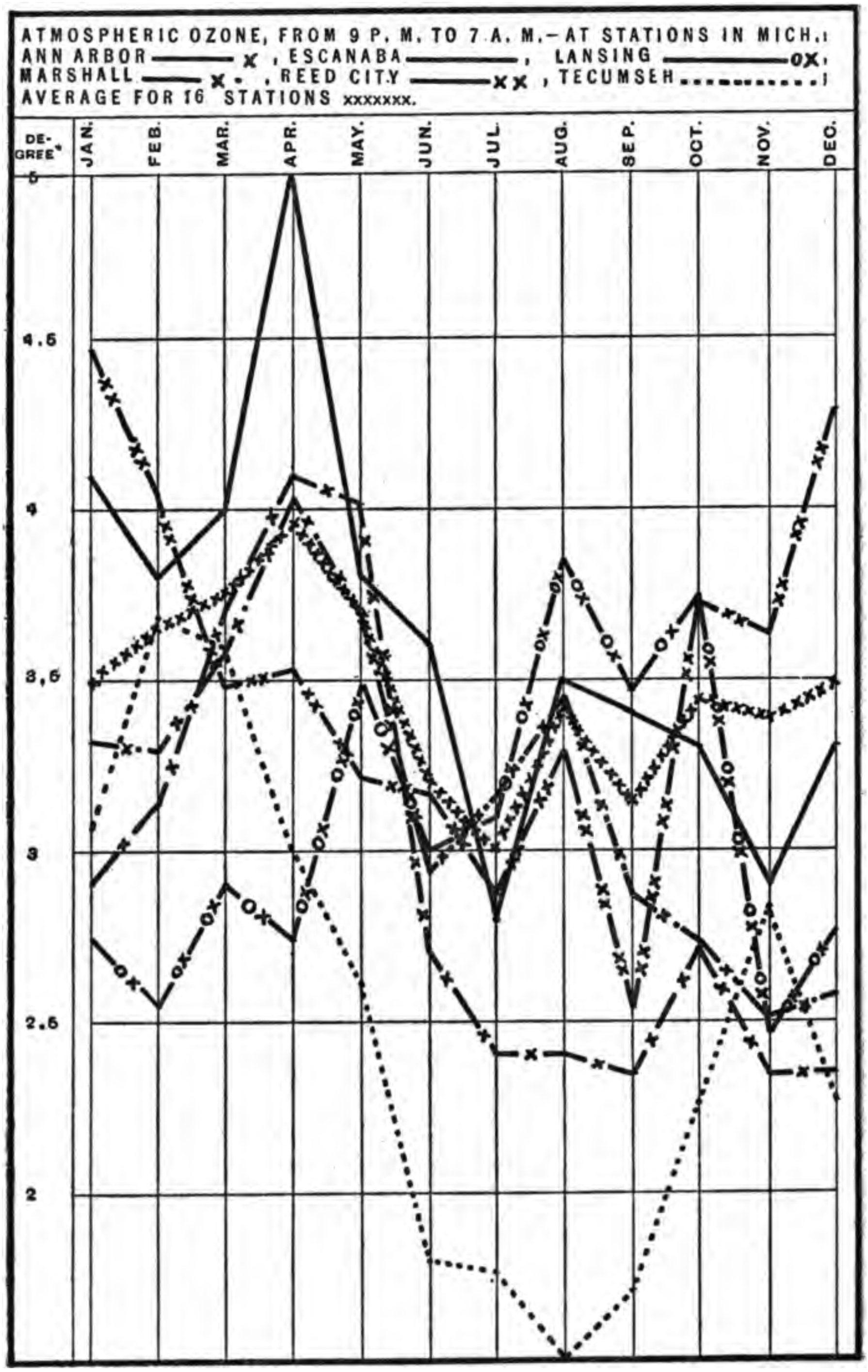
¶ The average for 7 months is 2.70. ‖ For 11 months, 3.12. †† For 11 months, 4.47. ** For 10 months, 3.08.

a, b, c. In the columns from January to December, inclusive, the letters a, b, c, etc., stand directly above the numbers from which they refer to the notes below.

a For 30 days. b For 29 days. c For 28 days. d For 27 days. e For 25 days. f For 23 days. g For 22 days.

Six lines in this table are graphically represented in Diagram IX., page 61.

DIAGRAM IX.—OZONE, AV. BY NIGHT, MONTHS IN 1885.



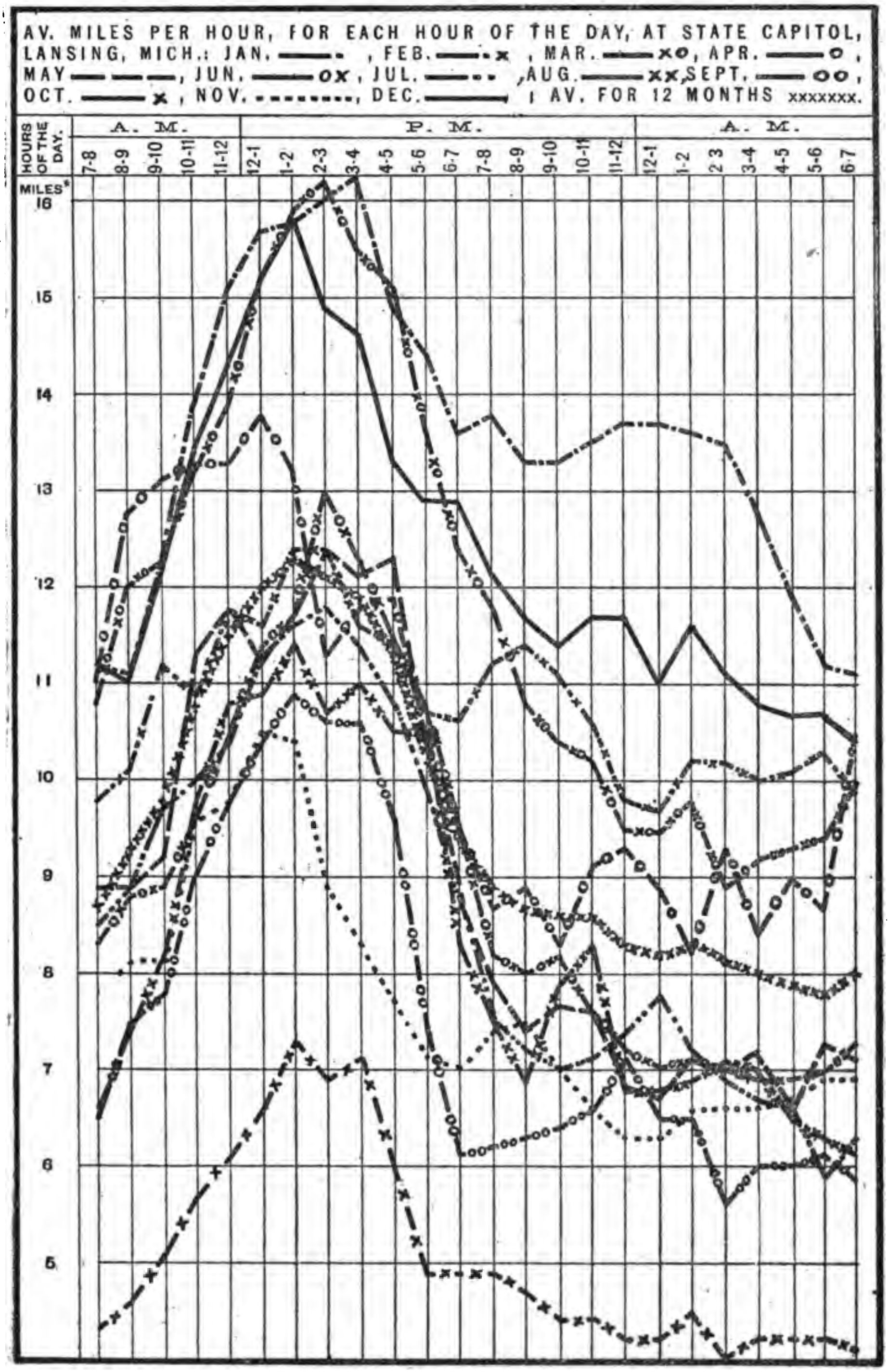
*SCALE, 1 DEG. OF COLORATION (ON SCALE OF 10 DEGS.) TO 1.85 IN. VERTICALLY.
H. B. T., DEL. DES. BY H. B. B.

TABLE X.—*Average velocity of the Wind, in Miles per Hour, for each Hour of the Day, by Months of the Year 1885. Compiled from Registers of the Robinson's Self-Registering Anemometer, exposed above the roof of the Capitol, and registering in the office of the State Board of Health, Lansing, Michigan.*

Months.	Average.			Hours (1885) and Average Miles Per Hour.																							
				A. M.					P. M.												A. M.						
	Av. six Years, 1880-85.	1884.	1885.	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	6-7
Year	10.0	9.8	9.5	8.7	9.3	9.8	10.8	11.5	12.0	12.3	12.1	11.9	11.3	10.3	9.4	8.9	8.7	8.6	8.6	8.3	8.2	8.3	8.1	8.0	7.9	7.8	8.0
January	11.4	11.2	13.6	11.2	11.1	12.3	13.9	15.1	15.7	15.8	16.0	16.3	14.9	14.4	13.6	13.8	13.3	13.3	13.5	13.7	13.7	13.6	13.5	12.8	11.9	11.2	11.1
February	11.4	7.0	10.8	9.8	10.1	11.2	10.9	11.8	11.6	12.4	12.4	11.6	11.4	10.7	10.6	11.2	11.4	11.1	10.6	9.8	9.7	10.2	10.2	10.0	10.1	10.3	9.9
March	11.4	8.4	11.9	10.8	12.0	12.3	13.2	13.9	15.2	15.9	16.2	15.5	15.1	13.6	12.4	11.8	10.8	10.4	10.2	9.5	9.5	9.8	8.9	9.2	9.3	9.4	10.0
April	11.6	11.9	10.5	11.0	12.8	13.1	13.3	13.3	13.8	13.2	11.3	11.8	11.9	10.4	9.5	8.7	8.9	8.3	9.1	9.3	8.9	8.2	9.3	8.4	9.0	8.7	10.5
May	10.2	11.2	9.0	8.9	8.9	9.2	11.3	11.8	11.2	11.7	12.4	12.1	12.3	10.4	8.7	7.9	7.4	7.7	7.6	6.8	6.7	7.1	7.0	7.2	6.6	7.3	7.1
June	8.9	7.2	8.9	8.3	8.8	8.9	9.6	10.5	11.4	11.7	13.0	12.3	11.5	10.8	9.5	8.2	8.0	8.2	7.6	7.2	7.0	7.1	7.0	6.9	6.9	7.0	7.3
July	8.7	9.2	8.6	8.5	8.9	9.7	10.0	10.4	11.3	11.6	11.8	11.4	10.8	9.9	8.8	7.5	7.2	7.0	7.1	7.4	7.8	7.2	6.9	6.7	6.6	5.9	6.3
August	7.5	8.4	8.3	6.6	7.4	8.2	9.8	10.8	10.9	11.4	10.7	11.0	10.5	10.5	8.3	7.5	6.9	7.9	8.3	6.8	6.8	6.9	7.1	7.0	6.5	6.3	6.1
September	8.5	9.4	7.6	6.5	7.5	7.8	9.0	9.8	10.4	10.9	10.6	10.6	9.6	7.4	6.1	6.2	6.3	6.4	6.6	7.1	6.5	6.5	5.6	6.0	6.0	6.1	5.9
October	8.3	10.1	5.1	4.3	4.6	5.1	5.7	6.1	6.6	7.3	6.9	7.1	6.0	4.9	4.9	4.9	4.7	4.4	4.4	4.2	4.2	4.5	4.0	4.2	4.2	4.2	4.1
November	10.9	10.8	7.7	7.8	8.1	8.1	9.6	9.8	10.5	10.4	8.9	8.3	7.7	7.1	7.0	7.4	7.5	7.0	6.6	6.3	6.3	6.6	6.6	6.6	6.7	6.9	6.9
December	11.2	12.3	12.4	11.2	11.0	12.2	13.4	14.3	15.2	15.8	14.9	14.6	13.3	12.9	12.9	12.1	11.7	11.4	11.7	11.7	11.0	11.6	11.1	10.8	10.7	10.7	10.4

The statements in the third figure-column in Table X. of the average velocity of the wind in miles per hour, by months, during the year 1885, are graphically represented in Diagram XI., page 67. The remaining columns of Table X. for 1885 are graphically represented in Diagram X., page 63.

DIAGRAM X.—VELOCITY OF WIND, BY HOURS AND MONTHS, 1885.



*Scale One Mile per Hour to .52 In. Vertically.

H. B. T., Del. Des. by H. B. B.

EXHIBIT 26.—*Average Velocity of the Wind in Miles per Hour, by Months, for the 6 Years, 1880–85, and comparisons of 1885 with this average and with the Year 1884. From Registers of the Robinson's Self-Registering Anemometer in the office of the State Board of Health, State Capitol, Lansing, Michigan.*

Years, Etc.	Miles, by Self-Registering Anemometer.												
	Annual Av.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 6 yrs, 1880–85	10.0	11.4	11.4	11.5	11.5	10.2	8.9	8.6	7.6	8.6	8.3	10.9	11.2
1884	9.7	11.2	7.0	8.4	11.8	10.9	7.2	9.1	8.4	9.4	10.2	10.8	12.2
1885	9.5	13.6	10.8	11.9	10.5	9.0	8.9	8.6	8.3	7.6	5.1	7.7	12.4
In 1885 **Greater** than Av. for 6 yrs, 1880–85	......	2.2	......	.4	......	......	......	......	.7	......	......	......	1.2
In 1885 **Less** than Av. for 6 yrs, 1880–85	.5	......	.6	......	1.0	1.2	0	0	......	1.0	3.2	3.2	......
In 1885 **Greater** than in 1884	......	2.4	3.8	3.5	......	......	1.7	......	......	......	......	......	.2
In 1885 **Less** than in 1884	.2	......	......	......	1.3	1.9	......	.5	.1	1.8	5.1	3.1	......

EXHIBIT 27.—DIRECTION OF WIND, 1878–85.—*Number of Observations per Month (at 7 A. M., 2 P. M. and 9 P. M.* Daily), at which the Wind was Blowing from the several (eight) Points of Compass. Annual and Monthly Averages for the eight Years 1878–85, at Stations in Michigan.†*

Points of Compass.	Average Number of Observations per Month,—8 Years, 1878–85.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
All Observations	91	93	85	93	90	93	90	93	93	90	92	90	93
Calm	5	4	4	4	4	5	6	7	8	6	5	4	4
North	7	5	6	9	9	8	7	7	8	6	7	5	5
Northeast	8	6	7	9	12	12	9	8	10	7	8	5	5
East	6	4	5	7	8	8	6	4	6	6	5	4	5
Southeast	9	8	9	10	9	10	10	7	9	9	10	8	8
South	10	12	10	8	7	10	11	10	10	13	14	12	10
Southwest	18	24	16	13	12	16	16	19	18	19	18	20	23
West	15	17	14	14	11	13	13	18	13	12	13	18	19
Northwest	14	14	13	19	17	12	11	13	13	12	13	14	14

* At stations of the U. S. Signal Service the observations were made at 7 A. M., 3 P. M. and 11 P. M., 75th meridian time.
† At 12 stations in 1878; 16 in 1879; 19 in 1880; 19 in 1881; 21 in 1882; 19 in 1883; 21 in 1884, and 21 in 1885.

DIAGRAMS RELATING TO METEOROLOGICAL CONDITIONS.

Most of the diagrams in this paper are to be read by tracing each irregular line across the diagram from left to right, and noting at what point it intersects each of the perpendicular lines having the name of a month at the top. What station is represented by the irregular line may be learned from the head of the diagram. The degree of value denoted by the intersection may be learned by referring to the figures in the left-hand column. Thus, in Diagram I., page 27, relating to average temperature in 1885, tracing the line—"°×," representing Traverse City, it may be seen that the average temperature at Traverse City was, in January, about 15°, in February, 7°, in April about 38°, in July about 70°, in October about 45°, etc. Definite numerical statements of the average temperature for each month at each station may be found in Table I., page 26, and accompanying each diagram is a table giving exact numerical statements for the conditions represented. The average line given in each table is in the corresponding diagram represented by an × line, thus××××××. The lines in the diagrams give more ready general comparisons of stations with each other, or of months with each other, than is possible from the mere numerical statements. By Diagram II., page 32, it appears at a glance that the average daily range of temperature at Traverse City in 1885, was, during March, higher than at any other of the eight stations represented in that diagram, and during December was considerably lower at Lansing. The marked agreement in the course of the lines in Diagram I., page 27, representing mean monthly temperature at six stations, and also that the agreement is closer in the last three months of the year than in earlier months, appear at once on reference to the diagram. The resemblance between the lines in Diagram I., p. 27, relating to mean temperature by months in 1885, and those in Diagram III., page 35, relating to absolute humidity of the atmosphere for the same periods, is apparent. By Diagram X., page 63, it appears that in every month of the year the highest velocity of the wind (on an average for the month) is reached between 12 M. and 3 P. M., and that the lowest velocity occurs in the latter part of the night or in early morning, and that in 1885, at Lansing, the months of most wind were January and March. By reference to Diagram XI., page 67, it may be seen that at other stations in Michigan where records of actual miles of wind traveled were kept, January, April, November and December were, in 1885, the months of greatest wind. These statements illustrate the reading of the diagrams for any use it may be desired to make of the tables and diagrams. The three diagrams relating to direction of wind are constructed on a different principle and the manner of reading them is explained on pages 69 and 74 of this article.

EXHIBIT 28.—*Average Velocity of the Wind in Miles per Hour by Year and Months in 1885, Compared with Annual and Monthly Averages for 1884, and for the 4 years 1882-85. From Registers of the Robinson's Self-Registering Anemometer*. These Averages are for Groups of Several Stations in Michigan.*

Years, Etc.	Average Miles per Hour.												
	Annual Av.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 4 y'rs, 1882-85	9.6	11.3	10.2	10.3	10.4	9.8	8.3	8.2	7.7	8.4	9.2	10.4	10.8
1884 (9 stations*)	9.3	11.1	9.2	8.8	10.1	9.4	6.8	7.9	7.9	9.0	10.5	10.3	10.8
1885 (8 stations*)	9.4	11.8	9.0	10.2	10.4	9.0	8.7	7.6	8.1	8.8	8.2	9.9	11.5
In 1885 **Greater** than Av. 4 years, 1882-85	......	.5	......	......	0	......	.4	......	.4	.4	......	......	.7
In 1885 **Less** than Av. 4 years, 1882-85	.2	......	1.2	.1	0	.8	......	.6	......	......	1.	.5	......
In 1885 **Greater** than in 1884	1.	.7	......	1.4	.3	......	1.9	......	.2	......	......	......	.7
In 1885 **Less** than in 1884	......	......	.2	......	......	.4	......	.3	......	.2	2.3	.4	......

* Gibbon's Anemometer was used at Ann Arbor.

TABLE XI.—*Average Velocity of the Wind in Miles per Hour for the Year and for each Month of the Year 1885, at 8 Stations in Michigan. Computed from Registers of the Robinson's Self-Registering Anemometer,* by Observers for the State Board of Health, and for the U. S. Signal Service.*

Stations in Michigan.†	Divisions of the State.	Miles, by Self-Registering Anemometer.													
		Year.		Months in 1885.											
		Norm. ‡	1885.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 8 stations§	....	......	9.4	11.8	9.0	10.2	10.4	9.0	8.7	7.6	8.1	8.8	8.2	9.9	11.6
Marquette	U. P.	......	¶	......	......	6.7	7.8	7.2	7.7	6.5	8.1	9.8	8.9	8.8	10.7
Escanaba	U. P.	8.8 [4]	9.0	9.6	7.8	9.3	9.9	9.4	9.1	7.6	9.1	9.6	8.7	8.4	9.5
Mackinaw City	N.	9.5 [2]	9.5	10.8	7.8	9.9	9.6	7.7	9.0	6.8	8.4	10.5	9.8	11.1	12.4
Alpena	N. E.	9.4 [4]	9.2	10.2	8.7	9.8	10.2	8.9	9.0	8.4	8.9	9.6	7.9	9.1	10.2
Grand Haven	W.	11.1 [4]	10.7	14.8	10.5	10.7	12.7	10.1	9.0	8.2	8.2	9.5	9.4	11.9	13.9
Port Huron	B. & E.	9.2 [4]	8.8	11.2	7.1	8.8	8.9	8.8	8.6	6.7	7.7	8.3	8.5	10.5	10.8
Lansing	C.	10.0 [6]	9.5	13.5	10.8	11.5	10.5	9.0	8.9	8.6	8.2	7.5	5.0	7.7	12.3
Ann Arbor*	S. C.	9.3 [4]	9.1	12.0	9.6	11.1	10.8	8.7	7.2	6.5	6.5	6.9	7.2	10.0	12.1
Detroit	S. E.	9.6 [4]	9.8	12.2	9.7	10.6	10.8	9.0	8.4	8.0	8.0	8.8	9.0	10.7	11.8

* Gibbon's Anemometer was used at Ann Arbor.

† The names of observers, their places of observation, and the counties in which these places are situated, are stated in Exhibit 1, page 9.

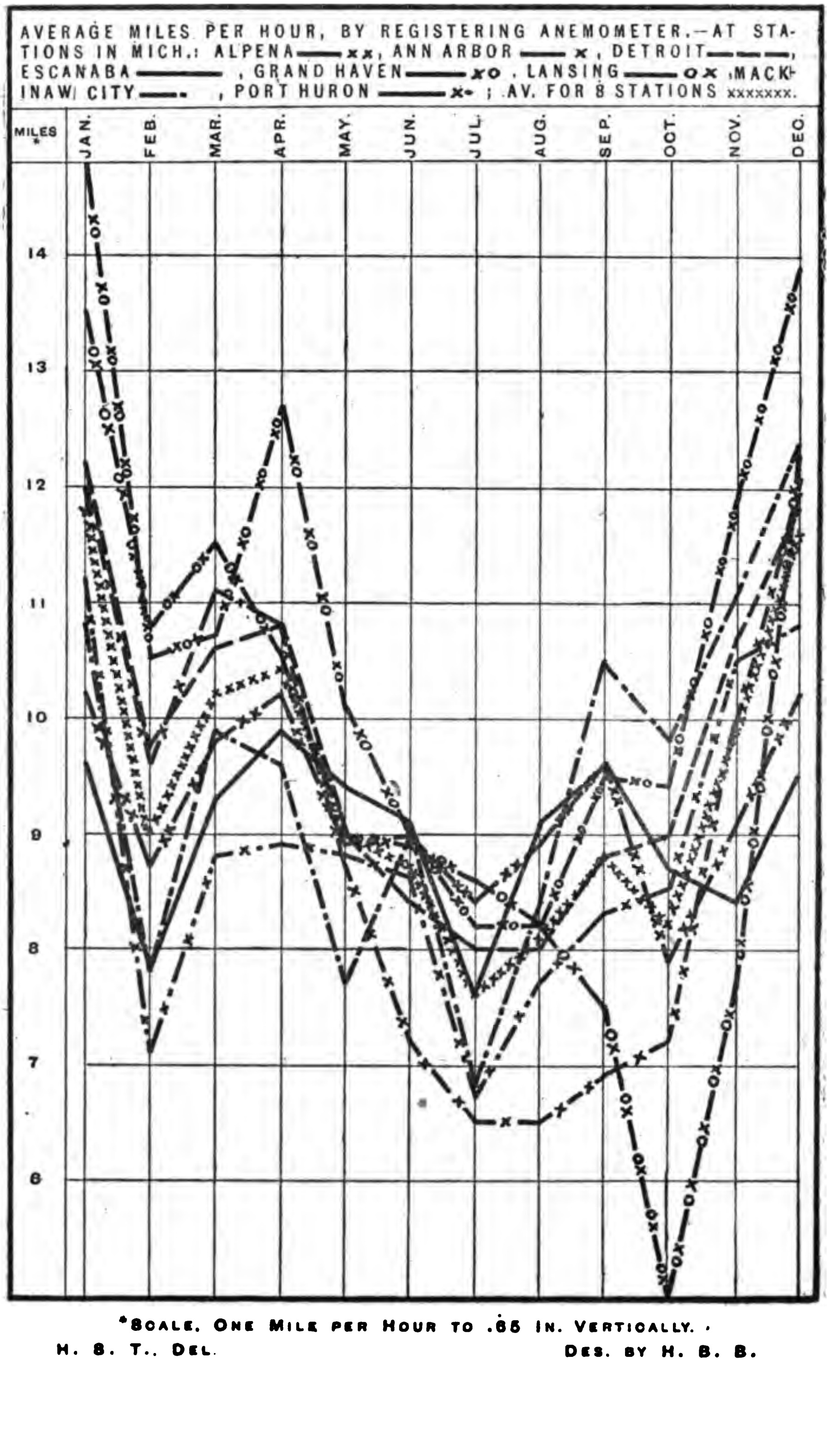
‡ Numbers in this column state the average velocity of the wind in miles per hour for periods of years ending in each case with Dec. 31, 1885. The small figures above and at the right of numbers which state the average denote the number of years included in the average.

¶ The average for 10 months in 1885, is 8.2.

§ This line is an average for all stations for which statements nearly complete are given for every month of the year. It does not include the line for Marquette.

Graphic representations of statements made in Table XI. are given in Diagram XI., page 67.

DIAGRAM XI.—VELOCITY OF WIND, BY MOS., IN 1885.



*Scale, One Mile per Hour to .65 In. Vertically.

H. S. T., Del. Des. by H. B. B.

TABLE XIII.—*Average Number of Observations per Month for the Year 1885, at which the Wind was Blowing from each of the Eight Principal Points of the Compass, at each of 21 Stations in Michigan; also the Average for the 21 Stations.**

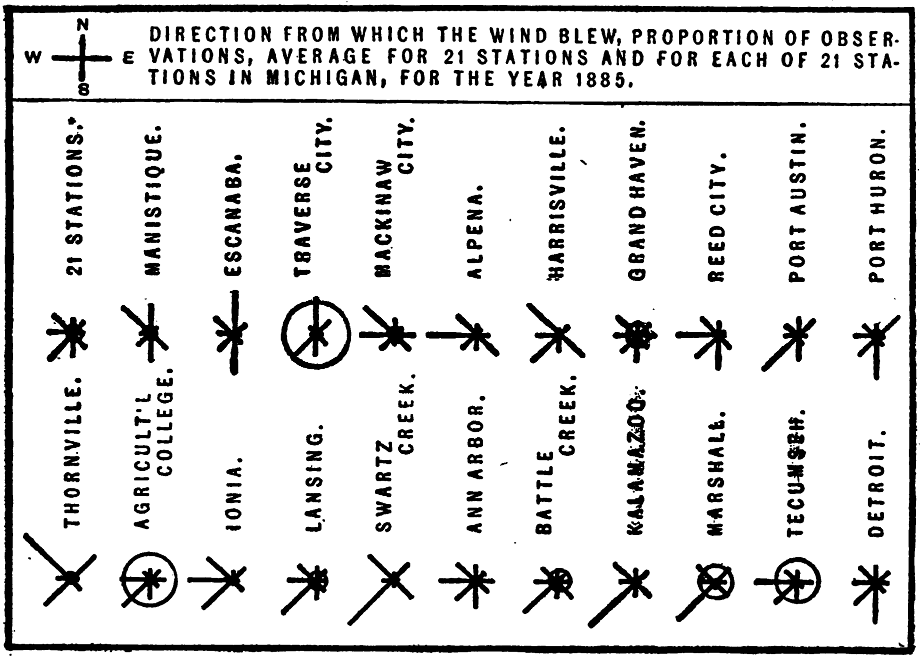
Stations in Michigan. (Those of the U. S. Signal Service in Italics.)	Divisions of the State.†	Average Number of Observations Per Month in 1885.									
		All Obs.	Calms	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.
Av. for 21 Stations	....	91	5	8	8	5	9	11	19	13	14
Manistique	U. P.	91	8	15	4	3	11	14	10	5	20
Escanaba	U. P.	91	0	22	8	3	5	20	12	8	13
Traverse City	N. W.	91	17	19	10	3	7	11	16	3	6
Mackinaw City	N.	91	4	8	5	10	10	5	10	18	22
Alpena	N. E.	91	2	5	4	7	15	8	11	26	14
Harrisville	N. E.	91	0	3	7	2	17	9	20	12	22
Grand Haven	W.	91	6	7	9	10	8	14	12	12	14
Reed City	W.	90	0	7	4	4	9	17	16	21	13
Port Austin	B. & E.	87	2	10	13	5	5	13	25	7	8
Port Huron	B. & E.	91	3	9	15	4	5	22	14	12	9
Thornville	B. & E.	91	3	2	17	3	5	1	20	8	33
Agricultural College	C.	91	14	5	7	8	6	10	20	15	6
Ionia	C.	90	1	4	9	4	8	3	22	23	17
Lansing	C.	91	5	7	7	4	6	10	25	16	12
Swartz Creek	C.	91	2	4	11	2	13	3	33	6	18
Ann Arbor	S. C.	91	1	7	6	10	9	14	14	19	12
Battle Creek	S. C.	91	6	5	6	7	12	9	24	12	11
Kalamazoo	S. C.	91	0	6	8	2	10	8	33	9	15
Marshall	S. C.	91	9	2	10	6	9	4	28	9	13
Tecumseh	S. C.	87	11	6	2	8	4	9	16	22	9
Detroit	S. E.	91	1	9	9	6	6	20	16	12	12

*** The names of observers, their places of observation, and the counties and divisions of the State in which these places are situated are stated in Exhibit 1, page 9.**

† The full names of the divisions, and the counties in each division, are stated in Exhibit I, in a paper which follows on weekly reports of sickness.

Graphic representations of statements in Table XIII. are given in Diagram XIV., page 69.

DIAGRAM XIV.—WIND, DIRECTION, AT STATIONS IN MICHIGAN, 1885.



H. B. T. DEL. DES. BY H. B. B.

*SCALE, RADIUS .01 OF ONE INCH TO ONE OBSERVATION. NUMERICAL STATEMENTS CORRESPONDING TO LINES IN THIS DIAGRAM ARE GIVEN IN TABLE PAGE

The construction and purport of the diagrams relating to direction of wind may be explained as follows:

In diagrams XII., XIII, and XIV., pages 75, 70 and on this page, relating to direction of the wind, the single figures or separate groups of lines are designed to indicate by the length of the lines the number and the proportion of regular observations at 7 A. M., 2 P. M. and 9 P. M.,* daily, at which the wind was blowing from each of the eight principal points of compass at the places and for the periods of time stated in the margin; and by the direction of the lines on the page, the direction of the wind. Each figure consists of lines drawn to a common center from some or all of the following directions on the page and indicating that at the times of observation the wind blew from points of the compass as follows: Lines toward the common center from the top of the page indicate observations that the wind was blowing from the north; from the right-hand side, observations that the wind was from the east; from the bottom of the page, that it was from the south; from the left-hand side, that it was from the west: from the upper left-hand corner, that it was from the northwest; from the upper right-hand corner, that it was from the northeast; from the lower right-hand corner, that it was from the southeast; from the lower left-hand corner, that it was from the southwest. The number of regular observations at which the wind was blowing from the direction denoted by a line is indicated by the length of that line, .01 of an inch being the unit or the length of line for one observation. The circles indicate calms, the number of regular observations at which there was no wind being denoted by the length of the *radius* of the circle drawn about the point of convergence of the lines for a given place or period of time, the length for one observation being, as before, .01 of an inch. Thus, by Diagram XII, page 75, or by Table XIV, pages 71-74, it appears that at Thornville, in August, 1885, at 10 of the regular tri-daily observations for the month there was a calm; at 2 observations the wind was blowing from the west; at 48 from the northwest; at 15 from the northeast, etc. For convenient study, the top of these diagrams should be held toward the north. Definite numerical statements corresponding to these diagrams are given in Tables XII., XIII. and XIV., pages 70, 68 and 71-74.

* At the stations of the U. S. Signal Service the observations were made at 7 A. M., 3 P. M. and 11 P. M., 75th meridian time.

TABLE XII.—*Number of Observations per Month (at 7 A. M., 2 P. M., and 9 P. M.,* daily), at which the wind was Blowing from each of the Eight Principal Points of Compass, during the Year and during each month of the Year 1885.—Average for 21 Stations in Michigan.*†

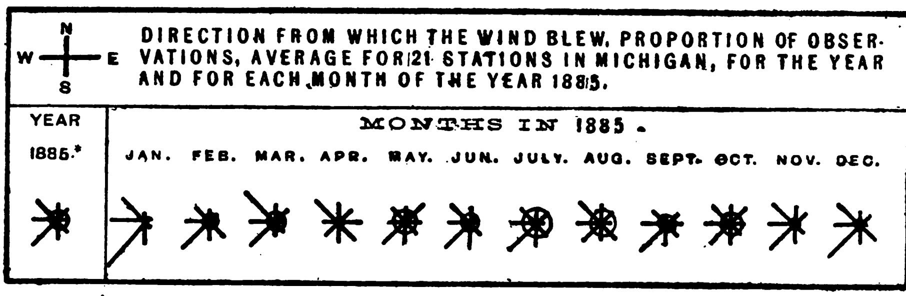
Points of Compass.	Average Number of Observations Per Month, 1885.												
	Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
All observations....	91	92	84	93	90	92	89	93	93	89	91	89	93
Calm	5	2	4	4	3	6	5	8	7	5	6	3	3
North...............	8	4	6	8	9	8	8	7	10	5	10	10	7
Northeast...........	8	4	5	8	9	13	5	8	9	8	12	9	6
East	5	2	4	3	11	8	2	4	5	8	7	3	4
Southeast...........	9	4	11	6	13	8	9	9	10	9	9	6	11
South	11	12	10	8	11	11	14	12	9	11	10	9	9
Southwest...........	19	31	20	19	10	17	19	20	13	20	15	18	24
West	13	18	13	14	9	10	12	14	13	13	10	14	14
Northwest...........	14	16	11	22	16	11	14	11	16	10	12	17	17

* At stations of the U. S. Signal Service the observations were made at 7 A. M., 3 P. M., and 11 P. M., 75th Meridian time.

† The names of observers, their places of observation, and the counties and divisions of the State in which those places are situated are stated in Exhibit 1, page 9.

Graphic representations of statements in Table XII. are given in Diagram XIII., below.

DIAGRAM XIII.—WIND, DIRECTION, IN MICH., YEAR AND MONTHS, 1885.



*SCALE RADIUS .01 OF ONE INCH TO ONE OBSERVATION.
H. B. T., DEL. DES. BY H. B. B.

TABLE XIV.—*Number of Observations for each Month of the Year 1885, at which the wind was Blowing from each of the Eight Principal Points of Compass, at each of 24 Stations* in Michigan; also the average for 21 of the said Stations from which nearly Complete Observations were received for the Year. (Observations made at 7 A. M., 2 P. M., and 9 P. M., Daily.)†*

Stations in Michigan. (Those of U. S. Signal Service in Italics.)	Divisions of the State.*	January.										February.										March.									
		Total.	Calm.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Total.	Calm.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Total.	Calm.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.
Av. for 21 stat'ns‡	....	92	2	4	4	2	4	12	31	18	16	84	4	6	5	4	11	10	20	13	11	93	4	8	8	3	6	8	19	14	22
Marquette	U. P.	.....	.....	....	....	....	....	..	....	....	....	.....	.....	....	....	....	....	..	....	....	....	93	4	24	3	1	6	7	7	10	31
Manistique	U. P.	93	4	15	1	1	1	3	21	15	32	84	9	13	0	3	10	16	6	6	21	93	15	17	6	4	6	8	7	3	27
Escanaba	U. P.	93	0	8	1	1	1	28	10	21	23	84	1	27	1	2	4	24	2	9	14	92	2	28	4	2	5	17	6	5	23
Traverse City	N. W.	93	6	5	5	0	1	15	39	9	13	84	16	10	5	0	4	24	15	3	7	93	14	24	6	0	5	20	9	1	14
Boyne City	N.	93	10	3	5	5	9	2	35	12	12	.....	.....	....	....	....	....	..	....	....	....	93	17	7	13	4	1	2	22	13	14
Mackinaw City	N.	93	2	11	3	6	2	6	8	37	18	84	6	4	3	5	13	6	7	26	14	93	3	3	4	7	8	2	9	21	36
Alpena	N. E.	93	2	1	2	1	4	10	23	40	10	84	3	2	2	3	17	5	7	23	22	92	1	1	1	5	13	5	7	34	25
Harrisville	N. E.	93	0	2	1	0	7	8	43	12	20	84	0	2	5	0	14	7	25	11	20	93	0	5	9	2	9	13	15	11	29
Grand Haven	W.	93	0	5	8	6	6	15	17	22	14	84	1	9	8	8	9	11	16	12	10	93	11	11	8	4	5	11	17	11	15
Reed City	W.	85	0	2	0	0	2	8	26	33	14	84	0	8	0	2	11	16	15	21	11	93	0	9	3	4	6	14	16	15	26
Port Austin	B. & E.	92	4	3	6	1	3	3	42	17	13	84	7	6	5	2	7	8	39	8	2	93	4	7	15	4	1	10	31	7	14
Port Huron	B. & E.	93	0	2	6	1	4	35	15	19	11	84	12	2	7	2	8	14	20	11	8	93	5	9	13	3	3	11	17	18	14
Thornville	B. & E.	93	1	0	6	1	5	1	29	11	39	84	5	2	2	9	14	3	18	15	16	93	5	0	11	3	4	1	21	21	27
Agr'l College	C.	93	8	1	8	0	2	18	31	18	7	83	13	5	1	4	9	11	23	16	1	93	14	2	11	1	8	3	24	23	7
Ionia	C.	93	0	0	4	2	10	1	40	4	32	84	0	0	15	7	12	1	24	3	22	93	0	2	18	0	11	0	23	5	34
Lansing	C.	93	1	5	2	2	0	15	40	21	7	84	0	8	1	1	9	15	29	17	4	93	1	6	5	4	5	6	24	16	26
Swartz Creek	C.	93	1	1	7	0	7	1	46	10	20	84	2	2	8	0	22	0	35	6	9	93	1	1	10	4	8	1	31	6	31
Ann Arbor	S. C.	93	0	2	4	5	3	18	17	30	14	84	0	7	4	15	6	8	14	24	6	93	0	8	11	3	6	6	18	26	15
Battle Creek	S. C.	93	2	1	9	4	5	8	50	9	5	84	1	6	3	7	12	9	31	10	5	93	1	13	6	3	5	5	31	9	20
Kalamazoo	S. C.	93	0	6	4	0	4	12	50	10	7	84	0	4	8	2	15	2	36	6	11	93	0	6	5	2	4	5	36	11	24
Marshall	S. C.	93	0	2	7	1	5	4	45	12	17	84	2	4	8	8	12	2	31	8	9	93	1	0	17	3	7	2	32	7	24
Tecumseh	S. C.	89	1	1	0	5	1	14	34	23	10	84	8	6	1	9	9	5	6	32	8	93	11	8	5	7	5	3	12	30	12
Birmingham	S. E.	.....	.....	....	....	....	....	..	....	....	....	.....	.....	....	....	....	....	..	....	....	....	93	17	8	4	2	3	7	12	26	14
Detroit	S. E.	93	0	5	3	2	4	29	27	17	6	84	0	8	14	3	5	14	25	12	3	93	0	13	4	6	4	19	17	13	17

Diagram XII., page 75, gives 14 lines in this table, and is explained on pages 69 and 74.
* For names of observers, etc., see Exhibit 1, page 9. For names of divisions, etc., see Exhibit I, in a paper which follows, on weekly reports of sickness.
† With exceptions stated for U. S. Signal Service Stations in Table I, page 26.
‡ This line includes only the 21 stations from which statements complete, or nearly complete, were received for every month of the year; it does not include Marquette, Boyne City, and Birmingham.

TABLE XIV.—CONTINUED.—*Direction of Wind, Months in 1885,—Observations at which the Wind was Blowing from Directions Named.*

Stations in Michigan.* (Those of U. S. Signal Service in Italics.)	Divisions of the State.*	April.										May.										June.									
		Total.	Calm.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Total.	Calm.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Total.	Calm.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.
Av. for 21 stat'ns‡	....	90	3	9	9	11	13	11	10	9	16	92	6	8	13	8	8	11	17	10	11	89	5	8	5	2	9	14	19	12	14
Marquette	U. P.	90	2	14	8	4	12	10	5	4	31	93	7	4	7	12	9	4	12	19	19	90	4	1	11	11	11	5	10	17	20
Manistique	U. P.	90	5	16	2	12	22	14	4	3	12	93	11	19	8	6	15	15	10	1	8	90	6	12	2	2	12	28	8	1	19
Escanaba	U. P.	90	1	30	7	8	6	26	3	1	8	93	0	28	2	4	4	35	7	1	12	90	0	20	2	3	9	36	3	5	12
Traverse City	N. W.	90	14	30	9	4	2	13	11	1	6	93	21	34	8	2	1	5	16	1	5	88	13	23	5	0	7	7	21	7	5
Boyne City	N.	90	10	2	27	8	12	0	26	5	0	93	2	0	27	7	3	0	24	5	25	90	0	4	8	6	7	4	16	9	36
Mackinaw City	N.	90	3	6	4	23	9	4	7	11	23	93	5	8	9	22	13	4	6	16	10	90	9	7	5	6	9	1	10	21	22
Alpena	N. E.	90	1	5	6	16	21	4	5	18	14	93	5	9	0	16	22	11	3	13	14	90	8	7	2	2	27	4	11	18	11
Harrisville	N. E.		0	5	10	4	22	7	8	9	25	93	0	6	11	2	29	9	8	13	15	90	0	2	3	1	17	19	16	14	18
Grand Haven	W.	90	5	9	14	13	7	13	9	3	17	93	9	5	9	11	1	20	14	8	16	90	6	4	5	6	2	23	17	13	14
Reed City	W.	90	0	6	7	1	20	22	10	3	21	90	0	5	4	12	11	16	32	4	6	90	0	4	1	1	12	20	19	22	11
Port Austin	B, & E.	90	4	17	17	5	8	15	10	8	6	90	0	3	27	15	5	8	26	5	1	90	3	14	7	4	4	20	21	5	12
Port Huron	B. & E.	90	0	14	16	7	6	21	4	6	16	93	2	15	27	3	1	24	7	6	8	90	1	15	13	1	3	32	13	7	5
Thornville	B. & E.	90	0	2	16	4	16	5	14	9	24	93	2	3	30	3	4	1	10	1	39	90	2	2	23	0	2	0	25	3	33
Agr'l College	C.	90	10	3	5	20	9	12	10	11	10	93	14	4	11	12	3	11	22	13	3	90	17	9	9	3	6	14	16	10	6
Ionia	C.	90	0	0	21	5	12	2	22	5	23	91	12	0	10	3	3	3	17	22	21	90	2	1	2	4	9	2	18	43	9
Lansing	C.	90	0	4	6	13	13	11	12	17	14	93	2	5	13	6	7	7	29	16	8	90	1	8	3	0	3	13	35	18	9
Swartz Creek	C.	89	3	6	10	9	16	3	19	3	20	92	3	3	20	3	9	4	32	6	12	90	1	7	5	0	16	2	35	5	19
Ann Arbor	S. C.	90	0	7	4	19	11	16	6	14	13	93	0	7	9	16	12	12	11	20	6	90	1	9	0	6	13	11	18	20	12
Battle Creek	S. C.	90	3	4	3	13	23	8	9	13	14	93	2	0	20	8	15	8	17	13	10	90	6	4	2	2	14	6	27	12	17
Kalamazoo	S. C.	90	0	5	15	8	10	13	13	8	18	93	0	8	16	1	6	8	29	10	15	90	1	3	4	2	6	14	37	8	15
Marshall	S. C.	90	5	0	7	17	15	3	15	10	18	93	17	1	16	8	7	4	20	12	8	90	15	1	8	4	4	12	28	5	13
Tecumseh	S. C.	90	2	3	2	17	10	4	15	21	16	89	24	0	6	5	0	7	23	18	6	82	18	5	1	1	5	7	17	17	11
Birmingham	S. E.	87	17	9	2	13	7	12	4	6	17	90	26	5	8	12	4	7	9	13	6	89	22	9	3	3	2	9	13	12	16
Detroit	S. E.	90	0	7	17	7	12	14	7	13	13	93	3	10	19	6	4	25	11	11	4	89	2	7	4	3	11	26	11	8	17

*, †, ‡. For these references see foot-notes to this table on page 71.

NOTE.—Graphic representations of statements for 14 lines in this table are given in Diagram XII, page 75, which is explained on pages 69 and 74.

TABLE XIV.—CONTINUED.—*Direction of Wind, Months in 1885.—Observations at which the Wind was Blowing from Directions Named.*

Stations in Michigan.* (Those of U. S. Signal Service in Italics.)	Divisions of the State.*	July.										August.										September.									
		Total.	Calm.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Total.	Calm.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Total.	Calm.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.
Av. for 21 stat'ns‡	... .	93	8	7	8	4	9	12	20	14	11	93	7	10	9	5	10	9	13	13	16	89	5	5	8	8	9	11	20	13	10
Marquette	U. P.	93	8	2	10	12	9	12	13	16	11	93	3	3	8	10	12	7	9	25	16	90	2	5	7	2	8	11	19	27	9
Manistique	U. P.	93	20	9	1	1	12	23	9	2	16	93	6	14	5	0	23	11	11	2	21	90	12	9	6	4	10	17	14	7	11
Escanaba	U. P.	93	1	20	2	1	20	35	2	5	7	93	0	29	11	3	10	14	15	8	3	90	0	7	14	4	1	10	35	9	10
Traverse City	N. W.	93	24	19	17	2	12	2	15	2	0	93	17	25	7	7	11	11	8	2	5	90	17	19	7	5	6	13	23	0	0
Boyne City	N.	93	4	5	17	2	3	0	14	15	33	90	2	1	21	5	12	2	10	12	25	90	14	0	13	13	12	0	13	12	13
Mackinaw City	N.	93	15	8	2	8	10	3	7	18	22	93	0	9	6	3	15	7	14	14	25	90	0	6	6	17	6	7	19	13	16
Alpena	N. E.	93	2	0	1	7	26	9	9	23	16	93	2	3	6	6	17	11	6	26	16	90	0	4	5	8	18	5	12	30	8
Harrisville	N. E.	93	0	4	4	1	17	17	21	13	16	93	0	3	5	3	15	9	22	14	22	90	0	2	11	2	14	6	21	21	13
Grand Haven	W.	93	9	6	4	7	7	20	9	17	14	93	11	11	6	12	9	12	6	9	17	90	7	5	2	17	12	17	11	12	7
Reed City	W.	88	0	10	1	2	2	23	19	27	4	93	0	7	9	2	8	12	6	32	17	90	0	2	0	8	1	27	15	31	6
Port Austin	B. & E.	92	2	22	18	8	1	17	17	2	5	85	0	20	14	6	3	19	12	2	9	86	0	7	10	5	8	16	25		9
Port Huron	B. & E.	93	3	9	32	3	7	22	8	6	3	93	1	13	20	6	6	17	9	10	11	90	0	7	18	6	5	19	18	12	5
Thornville	B. & E.	93	1	1	26	0	0	0	44	6	15	92	10	3	15	0	1	0	13	2	48	90	4	2	26	6	0	0	27	6	19
Agr'l College	C.	93	22	7	4	11	3	9	21	9	7	93	22	7	11	6	10	3	15	12	7	90	13	7	1	16	4	10	20	16	3
Ionia	C.	93	0	0	0	5	13	0	17	56	2	93	0	0	2	11	3	0	10	56	11	85	1	3	3	8	5	9	18	25	13
Lansing	C.	93	4	3	12	1	3	8	30	21	11	93	12	10	5	4	5	11	14	17	15	90	7	5	10	2	10	11	16	17	12
Swartz Creek	C.	92	4	2	14	2	11	2	35	3	19	93	3	6	14	0	14	4	27	6	19	90	1	1	11	1	15	3	37	1	20
Ann Arbor	S. C.	93	3	0	5	11	14	14	13	20	13	93	3	8	7	10	12	18	7	14	14	90	0	5	6	16	8	17	10	16	12
Battle Creek	S. C.	93	14	0	0	2	14	9	40	7	7	93	30	1	4	3	16	2	6	16	15	89	12	5	7	11	16	12	16	5	5
Kalamazoo	S. C.	93	0	4	5	1	4	7	37	19	16	93	0	11	7	2	12	5	28	10	18	90	0	5	7	1	16	8	28	9	16
Marshall	S. C.	93	17	1	6	3	1	9	32	11	13	93	18	3	13	5	10	1	23	4	16	90	15	2	7	11	15	3	20	9	8
Tecumseh	S. C.	93	19	4	2	6	3	7	21	25	6	93	9	18	6	7	6	9	10	14	14	74	13	5	1	10	2	11	13	11	8
Birmingham	S. E.	90	39	5	0	5	1	7	6	18	9	92	37	3	0	7	5	1	4	23	12	88	35	3	5	6	7	5	10	10	7
Detroit	S. E.	93	0	11	8	10	8	24	16	5	11	93	1	16	10	17	5	17	7	8	12	90	0	5	15	7	8	14	18	8	15

*, †, ‡. For these references see foot-notes to this table on page 71.
NOTE.—Graphic representations of statements for 14 lines in this table are given in Diagram XII, page 75, which is explained on pages 69 and 74.

TABLE XIV.—CONCLUDED —*Direction of Wind Months in 1885.—Observations at which the Wind was blowing from Directions Named.*

October.

Stations in Michigan.* (Those of U. S. Signal Service in Italics.)	Divisions of the State.*	Total.	Calm.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.
Av. for 21 stat'ns‡	....	91	6	10	12	7	9	10	15	10	12
Marquette	U. P.	93	0	15	7	7	3	11	13	27	10
Manistique	U. P.	93	6	19	4	2	8	15	14	4	21
Escanaba	U. P.	93	0	22	19	4	2	5	23	10	8
Traverse City	N. W.	93	21	14	19	5	10	5	13	1	5
Boyne City	N.	93	13	3	28	8	3	2	18	4	14
Mackinaw City	N.	93	0	12	4	15	13	6	14	13	16
Alpena	N. E.	93	0	7	7	12	7	10	15	24	11
Harrisville	N. E.	93	0	2	13	0	14	4	26	15	19
Grand Haven	W.	93	2	8	20	14	15	10	7	8	9
Reed City	W.	93	0	3	12	10	6	19	15	15	13
Port Austin	B. & E.	61	3	12	10	2	6	14	11	6	0
Port Huron	B. & E.	93	0	14	12	7	5	27	12	6	10
Thornville	B. & E.	93	6	4	19	4	8	0	11	2	39
Agr'l College	C.	93	20	7	11	11	3	9	14	12	6
Ionia	C.	87	0	13	13	2	7	5	20	19	8
Lansing	C.	93	14	10	12	7	5	8	21	6	10
Swartz Creek	C.	93	7	5	14	1	12	6	29	7	12
Ann Arbor	S. C.	93	8	10	10	8	8	17	9	10	13
Battle Creek	S. C.	92	2	10	8	5	13	13	10	17	14
Kalamazoo	S. C.	89	0	6	19	2	22	2	21	6	11
Marshall	S. C.	90	14	6	13	5	14	5	16	6	11
Tecumseh	S. C.	93	15	10	3	15	3	15	8	20	4
Birmingham	S. E.	91	23	10	8	2	10	11	6	13	8
Detroit	S. E.	93	0	12	10	8	4	23	13	6	17

November.

Stations in Michigan.	Total.	Calm.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.
Av. for 21 stat'ns‡	89	3	10	9	3	6	9	18	14	17
Marquette	90	3	13	12	2	3	6	8	30	13
Manistique	90	0	27	9	1	5	7	7	6	28
Escanaba	90	0	24	23	7	0	3	12	8	13
Traverse City	90	26	6	20	3	11	4	8	6	6
Boyne City	90	6	2	17	6	5	0	18	4	32
Mackinaw City	90	0	15	11	6	14	3	9	7	25
Alpena	90	0	8	11	7	4	11	13	30	6
Harrisville	90	0	5	6	4	15	5	16	3	36
Grand Haven	90	2	10	8	13	7	8	9	15	18
Reed City	90	0	17	5	2	11	17	8	20	10
Port Austin	89	0	1	23	0	5	8	28	13	11
Port Huron	90	2	5	7	2	3	22	17	22	10
Thornville	90	3	0	10	1	1	0	11	1	63
Agr'l College	90	8	9	7	4	2	11	15	28	6
Ionia	90	0	17	6	1	7	5	22	18	14
Lansing	90	7	13	4	0	5	8	26	12	15
Swartz Creek	90	1	7	9	1	11	4	32	8	17
Ann Arbor	90	0	11	2	2	6	14	24	19	12
Battle Creek	89	4	7	6	7	4	9	19	17	16
Kalamazoo	87	0	7	6	0	1	8	37	8	20
Marshall	90	3	2	13	5	5	7	31	11	13
Tecumseh	73	4	8	1	4	2	11	6	33	4
Birmingham	82	9	15	2	1	1	11	26	5	12
Detroit	90	0	10	2	3	3	18	23	17	14

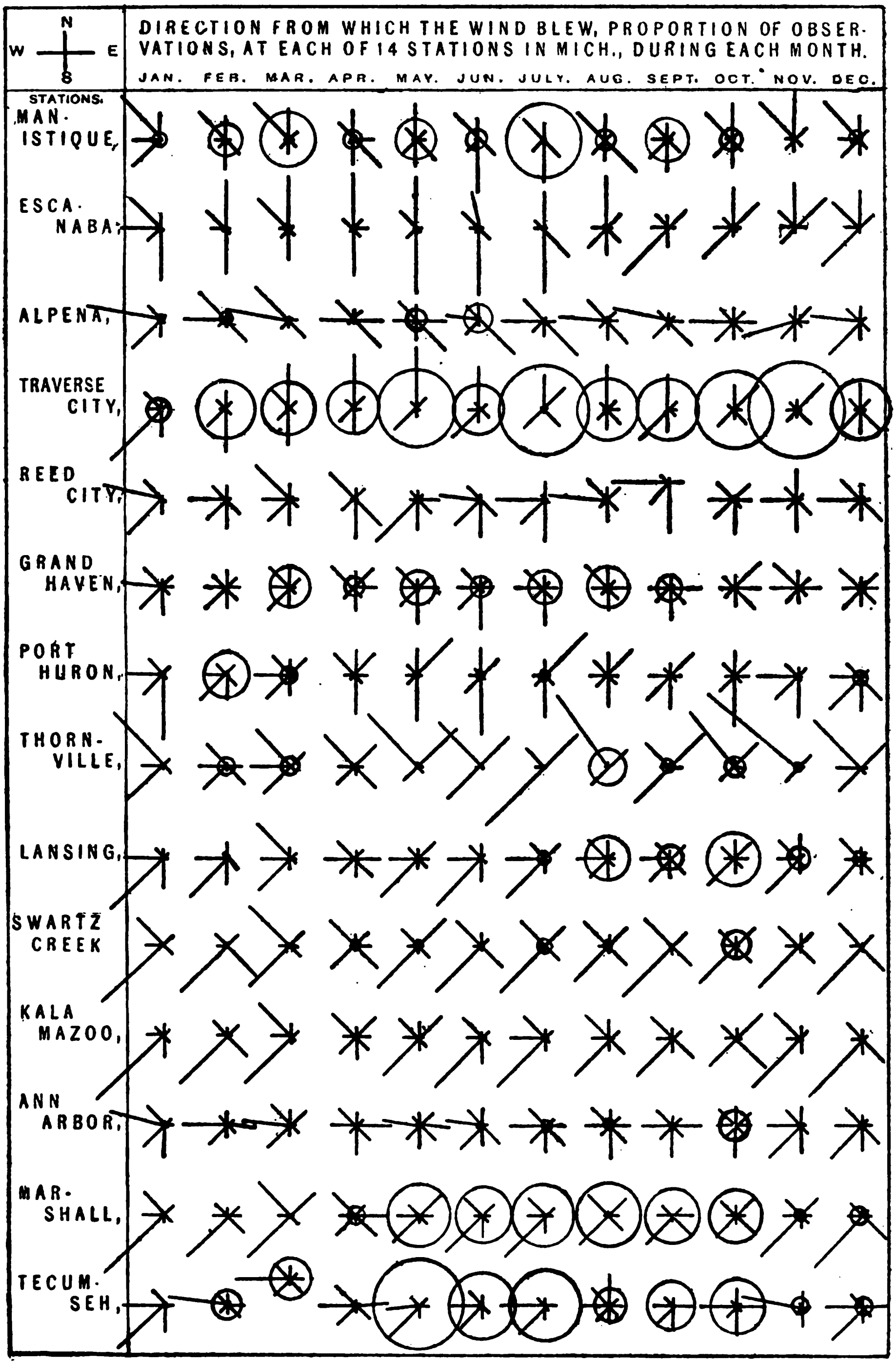
December.

Stations in Michigan.	Total.	Calm.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.
Av. for 21 stat'ns‡	98	3	7	6	4	11	9	24	14	17
Marquette	93	0	7	3	1	4	9	20	34	15
Manistique	93	4	12	7	0	7	9	14	12	28
Escanaba	93	6	20	11	0	0	4	29	9	20
Traverse City	93	16	14	8	2	17	12	14	2	8
Boyne City	93	4	0	10	4	11	0	31	3	30
Mackinaw City	93	0	12	6	2	7	13	7	14	32
Alpena	93	1	8	4	1	7	10	25	27	10
Harrisville	93	0	1	2	0	26	1	21	12	30
Grand Haven	93	3	6	12	10	11	10	15	10	16
Reed City	93	0	9	3	5	16	11	9	24	16
Port Austin	93	1	10	6	2	4	12	38	6	14
Port Huron	93	4	2	6	4	17	19	24	16	11
Thornville	93	0	0	18	4	4	0	17	14	36
Agr'l College	91	8	4	6	4	9	7	25	14	14
Ionia	87	0	9	8	1	7	3	27	15	17
Lansing	93	5	7	5	6	10	8	27	9	16
Swartz Creek	93	1	3	9	0	18	2	35	7	18
Ann Arbor	93	0	6	4	5	12	13	24	15	14
Battle Creek	91	0	4	1	13	10	13	26	19	5
Kalamazoo	93	0	5	4	0	16	8	42	6	12
Marshall	93	5	4	5	4	17	1	38	9	10
Tecumseh	93	5	4	1	13	6	9	24	21	10
Birmingham	92	9	6	7	4	7	9	21	15	14
Detroit	93	0	7	3	5	3	15	20	27	13

*, †, ‡. For these references see foot-notes to this Table on page 71.

NOTE.—Diagram XII., page 75, exhibits lines showing, by months, directions of wind at each of 14 stations in this table, the cut for each month and station in said diagram representing the figures given in this table for the same month and station; it is explained on page 69.

DIAGRAM XII. WIND, DIRECTION, AT STATIONS, BY MONTHS, IN 1885.



SCALE RADIUS .01 OF ONE INCH TO ONE OBSERVATION.
H. B. T. DEL. DES. BY H. B. B.

EXHIBIT 29.—*Average Atmospheric Pressure, by Year and Months, in 1885, compared with Annual and Monthly average for 1884, and for the nine years, 1877–85. These Averages are for Groups of several Stations in Michigan.**

Years, Etc.	Average Atmospheric Pressure.—Inches of Mercury.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 9 y'rs, 1877-85*	29.154	29.205	29.189	29.145	29.112	29.124	29.100	29.108	29.141	29.163	29.187	29.178	29.172
1884—(18 stations*)	29.205	29.274	29.204	29.202	29.147	29.131	29.273	29.100	29.216	29.210	29.268	29.213	29.229
1885—(19 stations*)	29.152	29.200	29.119	29.186	29.194	29.092	29.181	29.136	29.151	29.195	29.145	29.092	29.135
In 1885 **Greater** than Av. for 9 y'rs, 1877–85	------	------	------	.041	.082	------	.081	.028	.010	.032	------	------	------
In 1885 **Less** than Av. for 9 yrs, 1877–85	.002	.005	.070	------	------	.032	------	------	------	------	.042	.086	.037
In 1885 **Greater** than in 1884	------	------	------	------	.047	------	------	.036	------	------	------	------	------
In 1885 **Less** than in 1884	.053	.074	.085	.016	------	.039	.092	------	.065	.015	.123	.121	.094

* Kalamazoo for 1877–82 and 1885; Battle Creek for 1877–80, and 1882, Detroit for 1878–85; Woodmere Cemetery (near Detroit) for 1877–79; Mendon for 1877–8 and 1881–3; Marquette for 1879–84; Alpena, Grand Haven, Port Huron, Lansing for 1879–85; Benton Harbor, for 1877–8; Ypsilanti for 1877, 1879; Agricultural College for 1877 and 1881–5; Otisville for 1878–80 and 1882; Tecumseh for 1879–80 and 1882–5; Washington for 1879–80 and 1882–3; Nirvana for 1879 and in 1880 to April 25, inclusive; Reed City for 1880 after April 25, and 1881–5; Thornville for 1880–1 and 1884–5; Escanaba for 1880 and 1882–5; Traverse City for 1882–5; Ann Arbor for 1881–5; Harrisville for 1882, 1885; Hastings for 1882; Hillsdale for 1882–3; Port Austin for 1883–4; Marshall for 1883–5; Manistique, Mackinaw City, Ionia for 1884–5; Swartz Creek for 1885.

EXHIBIT 30.—*Comparisons of the Average Atmospheric Pressure during the Year and during each Month of the Year 1885, with Averages for the ten Years, 1875–84, and for the Year 1884. Corrected for Temperature and for Instrumental Error. Observations made at 7 A. M., 2 P. M. and 9 P. M., Daily, by Pof. R. C. Kedzie, at the State Agricultural College, near Lansing, Mich.*

Years, Etc.	Average Atmospheric Pressure.—Inches of Mercury.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 10 y'rs, 1875-84	29.057	29.080	29.067	29.003	29.004	29.042	29.025	29.049	29.071	29.103	29.076	29.085	29.081
1884	29.087	29.118	29.081	29.071	29.011	28.995	29.256	29.004	29.120	29.118	29.028	29.111	29.127
1885	29.068	29.144	29.006	29.093	29.097	28.988	29.105	29.052	29.061	29.115	29.056	29.013	29.062
In 1885 **Greater** than Av. for 10 yrs, 1875–84	.011	.064	------	.090	.093	------	.080	.003	------	.012	------	------	------
In 1885 **Less** than Av. for 10 yrs, 1875-84	------	------	.061	------	------	.054	------	------	.010	------	.020	.072	.019
In 1885 **Greater** than in 1884	------	.026	------	.022	.086	------	------	.048	------	------	.028	------	------
In 1885 **Less** than in 1884	.019	------	.075	------	------	.007	.151	------	.059	.003	------	.098	.065

EXHIBIT 31.—*Average Daily Range of Atmospheric Pressure, by Year and Months, in 1885, Compared with Annual and Monthly Averages for 1884, and for the four years, 1882–85. These Averages are for Groups of Several Stations in Michigan.*

Years, Etc.	Average Daily Range of Barometer.—Year and Months, 1885.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 4 yrs, 1882–85	.207	.325	.279	.298	.208	.171	.150	.125	.136	.156	.203	.228	.272
1884 (18 stations*).....	.179	.307	.232	.277	.205	.177	.116	.127	.154	.103	.203	.232	.281
1885 (18 stations*).....	.209	.319	.217	.267	.253	.148	.165	.118	.165	.173	.182	.181	.314
In 1885 **Greater** than Av. for 4 y'rs—1882–85..............	.002	......	......	......	.045	......	.015	......	.029	.017	......	......	.042
In 1885 **Less** than Av. for 4 y'rs—1882–85..................	......	.006	.062	.031	......	.023	......	.007	......	......	.021	.047	......
In 1885 **Greater** than in 1884.........	.030	.012	......	......	.048	......	.049	......	.011	.070	......	......	.033
In 1885 **Less** than in 1884..............	......	......	.015	.010	......	.029	......	.009	......	......	.021	.051	......

* Marquette for 1882–4; Escanaba, Traverse City, Reed City, Grand Haven, Lansing, Ann Arbor, Tecumseh for 1882–5; Alpena, Port Huron, Agricultural College, Detroit, Marshall for 1883–5; Washington, Mendon for 1883; Manistique, Mackinaw City, Thornville, Ionia for 1884–5; Harrisville, Swartz Creek for 1885; Port Austin for 1883–4.

EXHIBIT 32.—*Range of Atmospheric Pressure, by Year and Months, in 1885, compared with Annual and Monthly Averages for 1884, and for the four years 1882–85. These Averages are for Groups of Several Stations in Michigan.*

Years, Etc.	Range of Barometer.—Year and Months, 1885.												
	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 4 years, 1882–85..	.930	1.231	1.176	1.160	1.017	.769	.728	.577	.660	.848	.917	.952	1.127
1884 (18 stations*).....	.976	1.308	1.205	1.122	1.260	.828	.659	.571	.731	.967	.787	1.019	1.258
1885 (18 stations*).....	.906	1.356	1.160	1.068	.930	.709	.655	.525	.808	.737	.809	.800	1.317
In 1885 **Greater** than Av. for 4 y'rs—1882–85..............	......	.125	......	......	......	......	......	......	.148	......	......	......	.190
In 1885 **Less** than Av. for 4 y'rs—1882–85................	.024	......	.016	.092	.087	.060	.073	.052	......	.111	.108	.152	......
In 1885 **Greater** than in 1884.........	......	.048	......	......	......	......	......	......	.077	......	.022	......	.059
In 1885 **Less** than in 1884..............	.070	......	.045	.054	.330	.119	.004	.046	......	.230	......	.219	......

* Marquette for 1882–4; Escanaba, Traverse City, Reed City, Grand Haven, Lansing, Ann Arbor, Tecumseh for 1882–5; Alpena, Port Huron, Agricultural College, Detroit, Marshall for 1883–5; Port Austin for 1883–4; Washington, Mendon for 1883; Manistique, Mackinaw City, Thornville, Ionia for 1884–5; Harrisville, Swartz Creek for 1885.

TABLE XV.—*Average Daily Range of Atmospheric Pressure (as determined from three daily observations*) for the Year 1885, at each of 21 Stations, and the average for 20 of the same Stations in Michigan.—Stations arranged in order by Latitude, those farthest North first.*

Stations in Michigan.† (Those of the U. S. Signal Service in italics.)	Average Daily Range of Barometer,—Year and Months. 1885.														
	Norm. ‡	1884.	1885.	Jan.	Feb.	Mar.	Apr.	May.	J'ne.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 20 stations..¶	......	.....	.212	.319	.218	.266	.254	.148	.165	.120	.167	.175	.198	.191	.321
Av. for 18 stations..§	......	.....	.209	.319	.217	.267	.253	.148	.165	.118	.165	.173	.182	.181	.314
Manistique	.217^{2}	.229	.204	.295	.198	.306	.264	.156	.133	.139	.148	.164	.147	.191	.305
Mackinaw City	.222^{2}	.233	.211	.305	.218	.297	.257	.151	.158	.127	.157	.182	.172	.192	.321
Escanaba	.225^{4}	.229	.207	.284	.193	.280	.262	.153	.159	.137	.158	.179	.166	.204	.304
Alpena	.228^{3}	.226	.216	.322	.235	.296	.252	.151	.169	.128	:168	.186	.178	.185	.322
Traverse City	.223^{4}	.222	.215	.303	.208	.296	.267	.165	.171	.139	.173	.167	.178	.198	.319
Harrisville	......	.....	.227	.345	.243	.297	.267	.160	.188	.136	.174	.194	.197	.190	.329
Port Austin	.232^{3}	.222	.233	.332	.258	.291	.287	.162	.178	.121	.218	.189	.195	.195	.369
Reed City	.216^{4}	.213	.207	.316	.191	.250	.273	.191	.151	.144	.173	.164	.179	.153	.300
Grand Haven	.208^{4}	.204	.200	.316	.203	.275	.239	.135	.160	.103	.156	.157	.174	.176	.305
Swartz Creek	......	.....	.213	.337	.242	.260	.269	.150	.163	.113	.167	.179	.184	.172	.316
Ionia	.212^{2}	.209	.214	.273	.194	.272	.257	.164	.164	.124	.177	.178	.200	.227	.340
Port Huron	.217^{3}	.209	.220	.353	.240	.261	.292	.141	.162	.102	.174	.206	.200	.171	.337
Thornville	.207^{2}	.210	.203	.340	.230	.248	.146	.145	.170	.122	.167	.170	.184	.190	.324
Agricultural College	.204^{3}	.200	.198	.286	.211	.252	.248	.128	.158	.101	.172	.158	.185	.171	.309
Lansing	.209^{4}	.206	.202	.328	.216	.255	.249	.139	.160	.108	.154	.169	.178	.163	.306
Detroit	.215^{3}	.210	.212	.363	.242	.244	.263	.138	.200	.095	.173	.166	.188	.160	.316
Battle Creek	......	.....	.252	.317	.201	.227	.233	.138	.164	.141	.146	.206	.495	.369	.382
Kalamazoo	......	.....	.186	.304	.187	.220	.227	.119	.151	.092	.140	.147	.203	.150	.294
Ann Arbor	.207^{4}	.210	.199	.337	.222	.233	.248	.129	.157	.095	.156	.164	.179	.162	.303
Marshall	.214^{3}	.207	.206	.313	.217	.249	.278	.135	.159	.114	.168	.173	.188	.169	.307
Tecumseh	.207^{4}	.200	.201	.324	.199	.238	.224	.138	.182	.105	.158	.157	.195	.189	.297

* At stations of the U. S. Signal Service the observations were made at 7 A. M., 3 P.M., and 11 P. M., 75th Meridian time. The corresponding local time for each of these stations is stated in star (*) footnote to Table I., page 26.

† The names of observers, their places of observation, and the counties in which these places are situated, are stated in Exhibit 1, page 9. The average atmospheric pressure at each of these stations, by months, in 1885, is given in Table XVII., page 80.

‡ Numbers in this column state the average daily range of atmospheric pressure for periods of years ending in each case with Dec. 31, 1885. The small figures above and at the right of numbers which state the average daily range, denote the number of years included in the average.

¶ Not including Kalamazoo. § Not including Port Austin, Battle Creek, and Kalamazoo.

NOTE.—The latitude and elevation of some of these stations are stated in Exhibit 2, page 10.

TABLE XVI.—*Range of Atmospheric Pressure (as determined from 3 daily observations*) for the year and for each month and for the average month of the Year 1885, at 20 and at each of 20 Stations† in Michigan; also the Norm.—Average Monthly Range for a series of Years.—Stations named in order by Latitude, those farthest North first.*

Stations in Michigan.‡ (Those of the U. S. Signal Service in Italics.)	Range of Barometer,—Year and Months, 1885.															
	Norm. ††	1884.	Year.	Av. Month	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
For 18 Stat'ns¶	......	......	1.870	1.438	1.775	1.679	1.506	1.559	1.303	1.118	.983	1.318	1.691	1.211	1.247	1.870
Av. 20 stat'ns‖	......	......	1.870	.909	1.359	1.161	1.059	.919	.704	.651	.519	.807	.732	.817	.796	1.379
Av. 18 stat'ns**	......	......	1.870	.911	1.356	1.160	1.068	.930	.709	.655	.525	.808	.737	.809	.800	1.373
Manistique	.983 [9]	1.506	1.395	.920	1.329	1.125	1.186	.957	.839	.719	.573	.747	.688	.819	.847	1.210
Mackinaw City	.966 [2]	1.462	1.464	.946	1.369	1.145	1.232	.922	.787	.672	.586	.827	.671	.857	.875	1.403
Escanaba	.972 [4]	1.495	1.413	.922	1.319	1.082	1.196	.865	.822	.722	.614	.824	.664	.735	.902	1.321
Alpena	.990 [3]	1.460	1.554	.955	1.419	1.180	1.284	.929	.759	.668	.549	.873	.616	.802	.878	1.508
Traverse City	.970 [4]	1.468	1.477	.937	1.428	1.176	1.230	.886	.820	.706	.557	.800	.672	.683	.851	1.434
Harrisville	......	......	1.471	.940	1.424	1.143	1.217	.844	.757	.618	.589	.865	.668	.811	.872	1.471
Port Austin	.952 [3]	1.500	1.471	.930	1.435	1.229	1.097	.937	.710	.587	.506	.924	.710	.734	.837	1.451
Reed City	.900 [4]	1.494	1.204	.824	1.130	1.017	.949	.852	.669	.568	.480	.826	.843	.690	.700	1.167
Grand Haven	.915 [4]	1.413	1.532	.884	1.451	1.157	.983	.806	.646	.633	.471	.727	.725	.797	.768	1.445
Swartz Creek	......	......	1.464	.926	1.464	1.185	1.030	1.043	.642	.658	.512	.802	.736	.838	.794	1.413
Ionia	.935 [2]	1.472	1.438	.930	1.406	1.136	1.100	.891	.705	.637	.517	.823	.790	.845	.902	1.402
Port Huron	.959 [3]	1.539	1.507	.989	1.379	1.274	1.079	1.128	.650	.598	.505	.871	1.139	.919	.819	1.504
Thornville	.949 [2]	1.501	1.437	.944	1.437	1.259	.997	1.205	.639	.606	.545	.837	.750	.856	.770	1.429
Agr'l College	.891 [3]	1.402	1.433	.861	1.078	1.141	.970	.927	.617	.656	.485	.735	.741	.803	.746	1.433
Lansing	.905 [4]	1.418	1.457	.895	1.357	1.179	1.002	.939	.652	.671	.478	.777	.688	.813	.749	1 437
Detroit	.915 [3]	1.450	1.488	.914	1.402	1.233	.999	.956	.692	.647	.485	.812	.705	.821	.726	1.488
Battle Creek	......	......	1.943	1.006	1.348	1.099	.879	.802	.586	.629	.591	.732	1.121	1.855	.981	1.446
Kalamazoo	......	......	1.434	.848	1.347	1.103	.858	.710	.607	.633	.419	.658	.670	1.055	.681	1.431
Ann Arbor	.890 [4]	1.451	1.444	.891	1.355	1.167	.948	.941	.665	.630	.470	.805	.725	.769	.772	1.444
Marshall	.904 [3]	1.454	1.414	.892	1.379	1.169	.882	.871	.648	.659	.560	.785	.749	.831	.754	1.414
Tecumseh	.883 [4]	1.456	1.436	.824	1.273	1.114	.947	.776	.749	.722	.479	.814	.691	.866	.679	.783

¶ Represents the difference between the highest of 18 stations and lowest of 18 stations for year and for each month of year.

‖ Represents sum of ranges at 20 stations divided by 20. It does not include Battle Creek.

** Not including Battle Creek, Port Austin and Kalamazoo.

†† Numbers in this column state the average monthly range of atmospheric pressure for a period of years ending in each case with Dec. 31, 1885. The small figures above and at the right of numbers which state the average, denote the number of years included in the average.

NOTE.—The *, †, ‡ references and the note to Table XV., page 78, apply also to Table XVI.

TABLE XVII.—*Average Atmospheric Pressure for the Year, and for each Month in the Year 1885, at each of 21 Stations in Michigan, and also the Average for 19 of the same Stations, as indicated by the Height, in inches, of Mercury in the Barometer. Corrected for Temperature,—Reduced to 32° F., (for some Stations not corrected for Instrumental Errors*).—Average of Observations made Daily at 7 A. M., 2 P. M., and 9 P. M.,† by Observers‡ for the State Board of Health and for the U. S. Signal Service.*

Stations in Michigan.‡ (Those of the U. S. Signal Service in Italics.)	Divisions of the State.‡	Inches of Mercury.—Atmospheric Pressure. Years.		Months, 1885.											
		Norm.§	1885.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average for 19 stations ¶	....	....	29.152	29.200	29.119	29.186	29.194	29.092	29.181	29.136	29.151	29.195	29.145	29.092	29.135
Average for 18 stations ‖	....	....	29.164	29.211	29.130	29.197	29.207	29.105	29.195	29.150	29.165	29.209	29.161	29.105	29.148
Marquette *	U. P.	....	**	....	....	29.291	29.283	29.165	29.231	29.179	29.224	29.228	29.223	29.187	29.208
Manistique	U. P.	29.311 9	29.294	29.330	29.273	29.350	29.369	29.236	29.316	[b]29.263	29.314	29.237	29.313	29.243	29.281
Escanaba *	U. P.	29.322 4	29.288	29.321	29.256	[a]29.326	29.337	29.214	29.288	29.243	29.282	29.301	29.313	29.269	29.301
Traverse City	N. W.	29.344 4	29.315	29.343	29.285	29.354	29.367	29.272	29.337	29.290	29.312	29.347	29.320	29.272	29.278
Boyne City	N.	....	††	29.338	....	29.361	29.373	29.238	29.322	29.280	29.325	29.336	29.308	29.243	29.289
Mackinaw City *	N.	29.320 2	29.300	29.317	29.273	29.346	29.374	29.244	29.318	29.282	29.308	29.338	29.296	29.240	29.262
Alpena *	N. E.	29.356 13	29.291	29.292	29.232	29.301	29.345	29.249	29.310	29.282	29.306	29.350	29.307	29.245	29.272
Harrisville	N. E.	....	29.262	29.310	29.244	29.282	29.317	29.201	29.279	29.252	29.265	29.324	29.256	29.194	29.225
Grand Haven *	W.	29.340 13	29.312	29.366	29.281	29.347	29.341	29.241	29.346	29.294	29.309	29.354	29.294	29.262	29.308
Reed City	W.	28.909 7	28.916	[e]28.850	28.798	28.855	28.849	[b]28.781	28.877	[d]28.840	28.843	28.888	28.823	28.786	28.804
Port Austin	B. & E.	....	29.322	[c]29.323	[e]29.315	29.354	[f]29.381	[a]29.273	29.341	29.304	[d]29.338	29.370	[i]29.285	29.273	29.302
Port Huron *	B. & E.	29.323 7	29.298	29.322	29.268	29.337	29.342	29.240	29.324	29.284	29.288	29.352	29.288	29.235	29.292
Thornville	B. & E.	28.961 6	28.911	28.949	28.854	28.923	28.954	28.858	28.949	28.904	28.910	28.972	28.906	28.845	28.913
Agr'l College *	C.	29.088 4	29.066	29.144	29.006	29.093	29.097	28.988	29.105	29.052	29.061	29.115	29.056	29.013	29.062
Ionia	C.	29.262 2	29.229	29.339	29.226	29.291	29.281	29.169	29.286	29.234	29.239	[b]29.291	29.130	29.104	29.152
Lansing	C.	29.037 7	29.041	29.074	28.983	29.048	29.066	28.973	29.071	29.030	29.059	29.110	29.041	28.998	29.041
Swartz Creek	C.	....	29.147	29.187	29.093	29.177	29.182	29.080	29.169	29.125	29.130	29.186	29.236	29.076	29.126
Ann Arbor	S. C.	29.037 5	28.991	29.042	28.944	29.017	29.020	28.928	29.026	28.982	28.987	29.050	28.983	28.948	28.959
Battle Creek	S. C.	....	28.809	28.778	28.668	28.763	28.762	28.664	28.731	28.661	28.696	28.885	[b]29.011	29.020	[a]29.065
Kalamazoo *	S. C.	29.050 9	28.917	29.002	28.916	28.981	28.959	28.864	28.936	28.896	28.895	28.943	[c]28.850	[c]28.852	28.912
Marshall	S. C.	29.022 2	29.005	29.062	28.965	29.031	29.028	28.937	29.038	28.992	29.006	29.062	[a]28.988	28.951	28.998
Tecumseh	S. C.	29.132 4	29.102	[b]29.192	29.070	[a]29.154	29.133	[d]29.054	[d]29.148	29.079	[a]29.082	[g]29.144	29.083	[h]28.987	[a]29.097
Detroit *	S. E.	29.318 13	29.290	29.361	29.289	29.321	29.321	29.223	29.316	29.268	29.267	29.335	29.269	29.226	29.286

NOTE.—Computations of monthly averages for the year 1885 were furnished by the observers at Marquette, Escanaba, Mackinaw City, Alpena, Grand Haven, Port Huron, Detroit, and Ann Arbor. The remainder of the computations were made at the office of the State Board of Health.

* For stations marked thus * a correction has been made for instrumental error, as follows: For Marquette, .001 added; for Escanaba, .012 added; for Mackinaw City, .008 added; for Alpena, .006 added; for Grand Haven, .002 added; for Port Huron, .001 subtracted for January, and .011 added for months Feb. to Dec. inclusive; for Detroit, .017 added; for Agricultural College, .013 subtracted; for Kalamazoo, .18 subtracted. For other stations the instrumental error of barometer is not known.

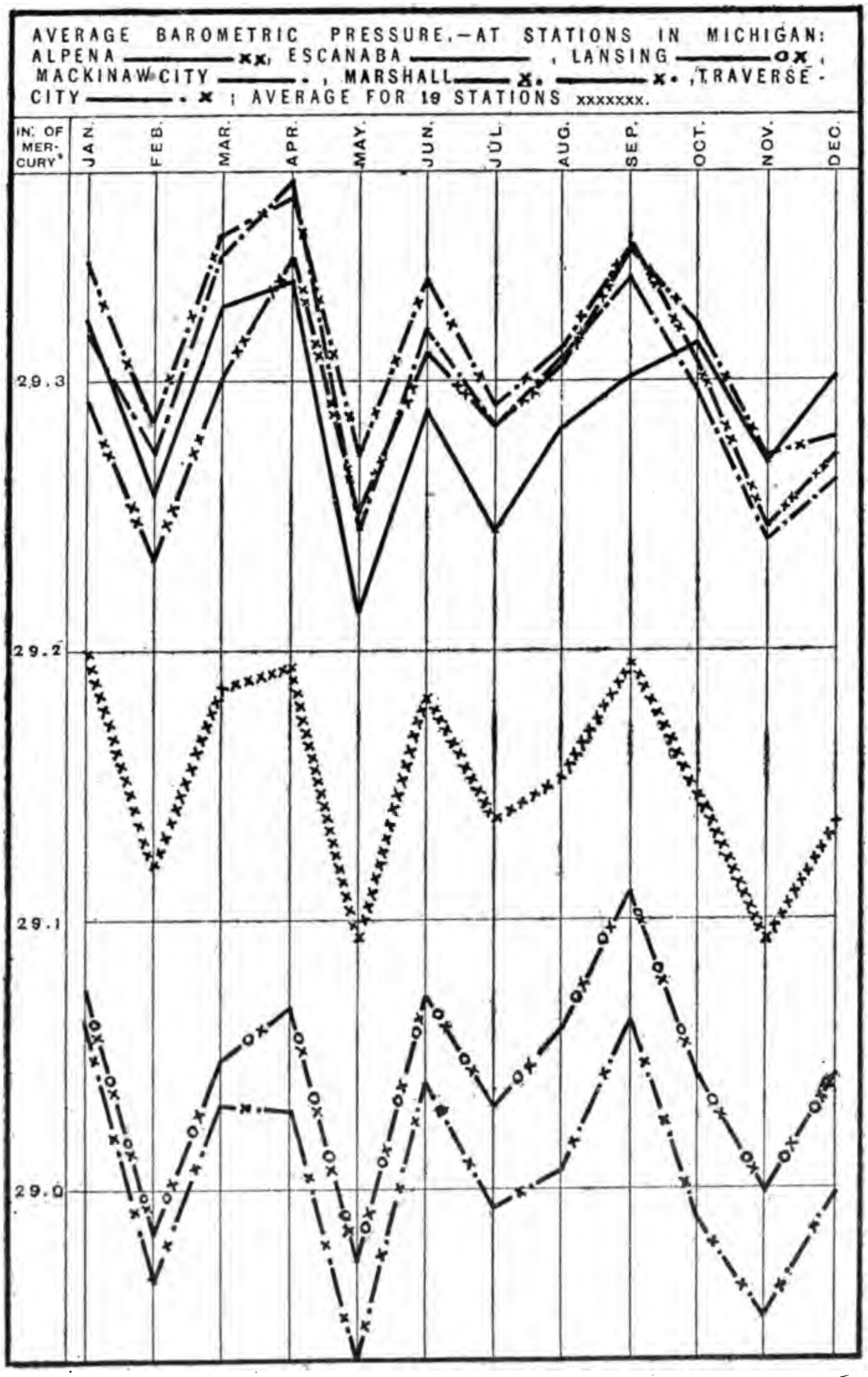
† At stations of the U. S. Signal Service for the year 1885, the observations were made at 7 A. M., 3 P. M., and 11 P. M., 75th meridian time. The corresponding local time for each of these stations is stated in the (*) foot-note to table I, page 26.

‡ The names of observers, their places of observation, and the counties in which these places are situated, are stated in Exhibit I, page 9. The full names of divisions, and the counties in each division, are stated in Exhibit I, in a paper which follows, on the weekly reports of sickness.

§ Numbers in this column state the average annual atmospheric pressure for a period of years ending in each case with Dec. 31, 1885. The small figures at the right of the numbers which state the average, denote the number of years included in the average. ¶ Not including Port Austin and Battle Creek.

‖ This line is an average for only 18 stations. It does not include Port Austin, Battle Creek and Kalamazoo. Green's standard barometer was used at all the 19 stations except Kalamazoo for 1885. The barometer at Kalamazoo was manufactured by J. Foster, Cincinnati, Ohio. ** The average for 10 months in 1885 is 29.222. †† The average for 11 months is 29.310. [a] For 30 days. [b] For 29 days. [c] For 28 days. [d] For 27 days. [e] For 26 days. [f] For 25 days. [g] For 24 days. [h] For 23 days. [i] For 21 days. The lines for 6 stations in this Table are graphically represented in Diagram XV., page 81.

DIAGRAM XV.—ATMOSPHERIC PRESSURE, BY MONTHS, IN 1885.



*SCALE ONE TENTH INCH OF MERCURY TO 1.45 IN. VERTICALLY.

H. B. T., DEL. DES. BY H. B. B.

THE TIME OF GREATEST PREVALENCE OF EACH DISEASE.

CONTRIBUTIONS TO THE STUDY OF THE CAUSES OF DISEASES.

A STATISTICAL REPORT BASED ON WEEKLY REPORTS OF SICKNESS IN MICHIGAN DURING THE YEAR 1885, AND PRECEDING YEARS.

BY THE SECRETARY OF THE STATE BOARD OF HEALTH.

This paper presents a summary of a compilation of the weekly reports of sickness in Michigan, and certain deductions made from these reports when studied in connection with a compilation of meteorological conditions for the year 1885. It includes a series of graphic illustrations which show the rise and fall of twenty-seven of the most prominent diseases occurring in Michigan, showing the times of greatest and least danger from each of these diseases. It includes also statements in the form of propositions calling attention to one method of learning certain laws that seem to grow out of the relations between the prevalence of certain diseases and the coincident meteorological conditions.

Since 1876, when this system of "weekly reports of diseases" was begun, an important work has been done in learning the time of the greatest prevalence of each disease, and consequently the time of greatest danger from each disease in the State considered as a unit. The certainty that has been reached that certain meteorological conditions invariably produce an increased or diminished amount of sickness from several of the diseases studied is of great practical importance, as it gives a clue to the methods which must be adopted for the prevention of each of these diseases. The study of the comparative prevalence of disease in the different parts of the State is a matter for subsequent study.

Weekly reports are now received concerning twenty-seven diseases, the names of which are printed on the blank, and concerning which a positive report is made each week.

Great credit is due the busy practitioners who forward the reports of sickness. Some of them have made the reports regularly since this plan was adopted in 1876. The service is, as a rule, without compensation. No other class of persons, however, has so great a knowledge of the facts that are necessary in the compilation of health statistics; and it is greatly to the credit of physicians that they are so willing to co-operate in every effort made to advance the public health.

PLAN OF THE WEEKLY CARD-REPORTS.

The plan of the weekly reports has been somewhat changed. The change was gradual for a time, but it culminated in May, 1885. Observers now report only the diseases under their own personal observation. There is now no guess-work or hearsay as to the diseases occurring under the observation of those who report to the Secretary of the State Board of Health. Formerly each observer reported all diseases that he believed to be present in his locality, whether under his own observation or not. The change in the plan of making the reports has, perhaps, diminished the number of reports of sickness, and may in part account for the apparent decrease in sickness in 1885. The actual observation of the reporter is, however, a sound scientific basis from which to calculate the actual sickness, and this seems to be the only way to learn the actual and the relative prevalence of the different diseases. The number of observers has also been largely increased by including the health officers of villages in the number of physicians who make weekly reports to this office. Previous to May, 1885, weekly reports were received from voluntary observers and from health officers of cities. The increased number of observers and the reporting of sickness under the observation of each has increased the value of the weekly reports as a source of information concerning the prevalence of diseases. Details of the method of securing, and the plan of making these reports may be thus stated:

The blanks for the weekly reports are printed on postal cards, which are supplied to the observers of diseases. Blank record books, in which to preserve copies of the reports, remarks, etc., are also supplied to these observers, to be retained by them. The reports are forwarded weekly to the Secretary of the State Board of Health, at Lansing.

The plan of making the report is as follows: Each observer is requested to mark the disease of which there was the greatest number of cases under his observation during the week for which the report is made, 1; that of which there was the next greatest number of cases, 2; the next, 3; and so on, applying *consecutive* numbers to the diseases reported present; but marking with the *same* figure all diseases of which there is the same number of cases; to write 0 opposite each disease mentioned of which there was no case; to apply these numbers without regard to the severity of the cases; to include all cases, without regard to when they were taken sick, so long as they are actually sick with the given disease; to include all cases "under the observation" of the observer. A blank is left on the card for the convenience of those observers who prefer to state the number of cases rather than the order of prevalence by the foregoing method.

To illustrate the method of making the reports, the following copy of one of the blanks now in use is given, correctly marked, in the "prevalence" column, for the number of cases stated on the right-hand margin. It should be remembered that the numbers in the "prevalence" column denote simply the relative order in which the several diseases appear to be prevalent, and do not denote a definite number of cases; so that a disease might one week be marked *4*, and the following week, with the same nnmber of cases, be marked *1*. Names of diseases and figures printed in italics are not *printed* on the postal blanks, but are supposed to have been *written* on the report by the observer.

Diseases in................................[and vicinity?]
PLEASE DATE.
week ending Sat.,.........................., *188*...

No.......		Prevalence. Order. See a.	*Cases.*
ED 23.	Brain, Inflammation of.....	*14*	*1*
	Bowels, Inflammation of....	*12*	*3*
	Bronchitis..................	*11*	*4*
	Cerebro-spinal Meningitis.	*0*	*0*
	Cholera Infantum	*8*	*9*
	Cholera Morbus.............	*10*	*6*
	Consumption, Pulmonary..	*10*	*6*
	Croup, Membranous........	*12*	*3*
	Diphtheria	*5*	*14*
	Diarrhea....................	*3*	*17*
	Dysentery...................	*8*	*9*
	Erysipelas..................	*13*	*2*
	Fever, Intermittent........	*2*	*21*
	Fever, Remittent...........	*11*	*4*
	Fever, Typhoid (Enteric)..	*0*	*0*
	Fever, Typho-malarial......	*9*	*7*
	Influenza	*7*	*11*
	Kidney, Inflammation of....	*14*	*1*
	Measles.....................	*1*	*27*
	Neuralgia	*14*	*1*
	Pneumonia..................	*9*	*7*
	Puerperal Fever............	*0*	*0*
	Rheumatism	*6*	*12*
	Scarlatina..................	*4*	*16*
	Small-pox...................	*0*	*0*
	Tonsilitis	*11*	*4*
	Whooping-cough	*0*	*0*
	Mumps	*6*	*12*
	Dyspepsia	*11*	*4*
	....	....	......

a. Please mark the disease of which there is the greatest number of cases, 1; the disease having next greatest number of cases, 2; the next, 3; and so on for each disease, writing the same figures opposite diseases having the same number of cases. Write 0 opposite each disease of which there is no case under your observation. [For full statement of plan, see second, third, and fourth pages of record-book cover.] A blank indicates that the item has been overlooked.
Please mail this, signed and dated, as soon as convenient after close of week specified.

This report is of diseases UNDER YOUR OBSERVATION; if it includes a contagious disease, please mention, on the bottom or margin of this card, the township, city, or village in which the disease is.

...., *M. D.*

BULLETINS OF "HEALTH IN MICHIGAN."

Since October 1, 1881, this office has issued a weekly bulletin of "Health in Michigan," compiled from weekly reports of physicians concerning sickness in various parts of the State. The bulletin is designed to give, each week, information to the public concerning the diseases which cause most sickness in the State, the relative amount of sickness compared with the corresponding week in preceding years, and in the preceding week,—the sudden increase or decrease in the prevalence of any disease, together with similar comparisons of meteorological conditions, and a list of the localities at which the dangerous communicable diseases are reported present. A copy of this bulletin has been regularly sent to such editors as have expressed a wish to have it for use, entire or in part in their papers. In 1885 about fifty copies have been thus used each week.

In August, 1884, a series of *monthly* bulletins of health in Michigan was begun. These bulletins have been continued throughout the year 1885. They are similar to the weekly bulletins, and are issued as soon as possible after the close of each month, and sent to the sanitary and medical journals

which are received as exchanges by the library of the State Board of Health.

As a rule, about one-half of the card-reports reach this office in time to be compiled for the weekly bulletin; and the monthly bulletins are compiled from the information used in the weekly bulletins. By careful comparison it is found that the statements made in the monthly bulletins in 1885, as in 1884, are corroborated by the information obtained in the compilation of the whole number of reports for the corresponding months of the year, thus showing that the information brought out by about one-half of the observers is substantially the same as the information brought out by the entire number, whose cards are compiled at the end of the year. This reinforces the assertion made last year that a sufficient number of weekly reports are received to supply probably true average statements of the sickness which occurs throughout the State.

COMPILATION OF THE WEEKLY REPORTS.

Some of the methods of compiling the reports are set forth in connection with the tables on following pages; it is somewhat more fully explained on pages 306, 307 and 310 of the Report for 1881.

Table 3, giving statements by months for each locality from which reports were received for 1885, has been prepared; but to avoid making bulky volumes it has not been printed in the reports since that of 1882. The manuscript is preserved for reference and future study.

THE PREVALENCE OF THE SEVERAL DISEASES IN 1885.

By noting the per cent of all the reports received for a given time which stated the presence of each disease, the relative prevalence of the several diseases may be readily seen. This per cent has been computed for each disease, by months and for the year 1885. It is thus stated in Exhibit II., page 88, which also states the per cent for each disease for each of the preceding eight years. What per cent of the reports stated the presence of each disease by months in 1885, is graphically represented in diagrams 1–5, on page 89, and following pages.

For several diseases a comparison has been attempted of the amount of sickness in 1885 (as indicated by the proportion of reports stating the presence of the disease) with the average amount for a period of nine years. These comparisons are shows in Exhibits XI., XIII., XVIII., and XX. A comparison is made in Table 1, pages 94, 95, and 96, between the number of observers reporting the tabulated diseases present in each of the years 1877–1885, and by months in a part of those years. In Exhibit IV., on pages 91, 92, and 93, the per cent of reports stating the presence of each of the 27 tabulated diseases for the years 1877-1885, and by months in a part of those years is given. In Table 1, and in Exhibit IV., the diseases are arranged in the order of the greatest per cents for 1885.

A study of the reported sickness from 27 diseases, in connection with meteorological conditions by months in 1885, is made in Exhibit X., and following exhibits. By arranging months in order of greatest prevalence of the disease under consideration, noting whether it was more or less prevalent than the average for the year, and noting what were the meteorological conditions for the same months, as compared with the average for the year. relations and comparisons are grouped for convenient comparison. A summary of one line of the evidence of these exhibits is given in Exhibits XXIV. and XXV.

In Exhibits VI. and VII., on pages 113, 114, and 115, the leading diseases are arranged in order according to the amount of sickness reported from them in 1885, those from which there was most sickness reported being placed first; thus indicating what diseases cause most sickness. It will be noticed that for the State, in 1885, as in 1884, neuralgia heads the list. In 1885, intermittent fever takes second place, and rheumatism third place.

The comparison with former years is facilitated by reference to Exhibit II., page 88, Table 1, pages 94, 95, and 96, Exhibit IV., pages 91, 92, and 93, and Exhibits XI., XIII., XVIII., and XX.

Exhibit IV., on pages 91, 92, and 93, has been added to the exhibits of 1885. In it the diseases are arranged in order of the greatest per cent of reports stating the presence of the disease in 1885. It is similar in form to Table 1, page 94, which shows the per cent of observers by whom diseases were reported present. It affords a means for the comparison of the per cent of reports in 1885 with the average per cent of reports in the nine years 1877-1885, both for the year and by months, also by months in 1885, with several of the years previous to 1885.

DISEASES FROM WHICH THERE WAS A MARKED INCREASE OR LESSENED PREVALENCE IN MICHIGAN IN 1885.

By referring to Exhibits XI., XIII., XVIII., and XX., it will be seen that all the prominent diseases except neuralgia, tonsilitis and rheumatism have shown a marked decrease for 1885 as compared with the average for nine years, 1877-1885. The most marked decrease for the year appears from the reports of presence of intermittent fever, remittent fever, pneumonia, diphtheria, measles, consumption, scarlet fever, typho-malarial fever, and influenza. For the year, rheumatism shows neither an increase or decrease in the per cent of reports when compared with the nine years 1877-'85. It shows an equal or increased prevalence in all the months of the year 1885, when compared with the average of corresponding months in the nine years 1877-1885, except in the months of October, November and December. Tonsilitis showed a slight increase for the year, and for each month of the year 1885 over the average for the nine years 1877-'85, except in the months of February, April and December, and in April and December there was neither increase nor decrease. Neuralgia showed an increase for the year and for each month of the year when compared with the average for seven years 1879-'85, except in May, October and November, and in May there was neither an increase nor decrease in the prevalence of the disease. A part of the lessened prevalence of many of the prominent diseases *may* be due to the change in the method of reporting sickness, referred to on page 83. It is very probable, however, that only a small part of the lessened prevalence can be attributed to this change in making the reports. Many prominent physicians have referred at various times during the year to the marked healthfulness of the season, or to the entire absence of the usual diseases.

On pages 230 and 253 of the Report of this Board for 1885, the divisions and the counties in each were indicated by lines on maps of the State. Similar maps appear in the articles on diphtheria and scarlet fever near the end of the present report.

EXHIBIT I.—*Eleven Geographical Divisions of the State, formed for the purpose of facilitating the study of Causes of Sickness and of Deaths, with a list of Counties included in each Division.*

1.-Upper Peninsular.	2.-North-western.	3.-Northern.	4.-North-eastern.	5.-Western.	6.-Northern-Central.	7.-Bay and Eastern.	8.-Central.	9.-South-western.	10.-Southern-Central.	11.-South-eastern.
Alger.	Benzie.	Antrim.	Alcona.	Kent.	Clare.	Arenac.	Barry.	Allegan.	Branch.	Macomb.
Baraga.	Gr. Traverse.	Charlevoix.	Alpena.	Lake.	Gladwin.	Bay.	Clinton.	Berrien.	Calhoun.	Monroe.
Chippewa.	Leelanaw.	Cheboygan.	Iosco.	Mason.	Isabella.	Huron.	Eaton.	Cass.	Hillsdale.	Oakland.
Delta.	Manistee.	Crawford.	Montmorency.	Muskegon.	Mecosta.	Lapeer.	Genesee.	Van Buren.	Jackson.	Wayne.
Houghton.	Manitou.	Emmet.	Ogemaw.	Newaygo.	Midland.	Saginaw.	Gratiot.		Kalamazoo.	
Iron.	Missaukee.	Kalkaska.	Oscoda.	Oceana.	Roscommon.	Sanilac.	Ingham.		Lenawee.	
Isle Royal.	Wexford.	Otsego.	Presque Isle.	Osceola.		St. Clair.	Ionia.		St. Joseph.	
Keweenaw.				Ottawa.		Tuscola.	Livingston.		Washtenaw.	
Mackinac.							Montcalm.			
Marquette.							Shiawassee.			
Menominee.										
Ontonagon.										
Schoolcraft.										

EXHIBIT II.—*Stating for each of 27 Diseases for the nine Years ending Saturday, January 2, 1886, for each of those Years, and by Months of the Year 1885, on what Per Cent of the Reports Received the Disease was stated to be Present.--Compiled from Weekly Reports by Health Officers of Cities and Villages, by Regular Correspondents of the State Board of Health, and by other physicians.**

Diseases.	What Per Cent of Reports Received State the Presence of the Disease.																					
	Av., 1877-85.	Years.									Months, 1885.											
		1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average........†	30	28	30	33	32	33	30	30	29	26	29	29	30	28	25	24	26	27	27	26	26	26
Brain, inflam. of	6	....	....	....	6	5	5	6	7	6	8	7	9	11	5	7	6	6	5	5	5	6
Bowels, inflam. of	15	....	....	....	12	14	13	16	17	17	14	16	20	17	18	18	16	20	13	17	16	17
Bronchitis........	62	55	64	64	64	62	65	66	61	56	73	74	76	73	56	52	44	39	45	51	58	64
Cer.-spi. Men....	5	3	2	2	2	9	6	5	7	6	8	9	12	8	6	5	8	6	6	5	2	4
Cholera Infant..	13	11	11	14	14	18	12	14	15	11	3	1	1	2	5	7	22	35	18	8	4	2
Cholera Morbus.	19	15	14	19	20	26	17	18	22	17	3	4	8	7	10	18	40	47	26	11	7	5
Consump., Pul...	64	52	71	70	68	71	66	61	63	58	60	68	71	69	58	61	56	52	54	55	56	56
Croup, Mem......	7	6	7	7	6	9	7	6	6	5	16	10	10	6	3	3	2	1	3	3	5	5
Diphtheria.......	23	19	23	29	27	34	25	17	15	14	14	10	11	16	9	12	14	13	15	19	16	17
Diarrhea..........	47	41	41	48	47	52	48	49	52	46	26	31	35	33	36	44	65	77	65	44	33	27
Dysentery........	19	21	19	18	18	23	17	21	23	15	8	7	7	9	7	11	16	34	29	16	12	7
Erysipelas........	23	20	21	25	25	23	22	25	26	24	32	35	35	29	27	24	21	16	17	18	26	28
Fever, Intermit.	74	75	82	82	82	82	71	69	65	59	51	52	51	57	64	68	67	65	65	60	55	49
Fever, Remittent	50	52	58	57	56	54	48	41	44	36	33	32	43	38	33	35	32	39	40	39	38	31
Fever, Typhoid (Enteric).........	13	14	10	12	14	18	14	11	12	8	11	7	5	4	3	5	5	6	11	13	16	8
Fever, Typho-Malarial........	23	26	24	22	24	29	24	18	20	16	15	16	14	10	11	10	10	15	24	25	21	14
Influenza.........	41	41	44	45	42	35	40	43	41	34	58	60	52	48	31	23	18	18	30	31	37	40
Kidney, inflammation of........	24	....	....	....	....	....	....	....	26	21	26	27	24	22	22	21	18	19	17	21	19	20
Measles...........	13	7	5	12	19	26	11	24	10	5	4	7	10	10	9	7	8	2	2	1	3	3
Neuralgia.........	66	....	....	59	64	65	68	69	70	68	79	79	77	75	67	67	61	58	64	62	67	73
Pneumonia.......	38	40	41	41	42	41	39	38	29	27	50	58	60	50	31	19	11	10	12	17	22	31
Puerperal Fever	5	4	3	3	3	5	7	7	7	6	4	5	10	8	6	5	5	5	4	5	7	7
Rheumatism.....	68	60	68	72	71	71	68	68	70	68	73	76	82	79	74	71	63	59	60	64	70	70
Scarlatina........	19	21	25	23	15	19	18	19	16	12	16	18	14	13	13	15	13	8	7	13	11	11
Small-pox.........	1.2	4	0.2	0.4	0.4	2	3	0.3	0.1	0.2	0	1	0.4	0.3	1	1	0	0	0	0	0	0
Tonsilitis.........	49	....	....	45	49	48	48	50	50	50	63	58	61	53	50	43	38	37	42	48	58	60
Whooping-cough	20	21	21	23	32	16	17	15	23	14	18	16	20	17	9	10	14	16	16	15	14	13
No. reports rec'd	4014	3320	3221	3755	3991	3567	4745	4458	3957	5108	280	274	271	314	347	399	564	485	601	495	498	580

Statements in this exhibit for months in 1885 are graphically represented in Diagrams 1, 2, 3, 4, 5, opposite this page and on following pages.

* For 1885 the names of observers are stated in Exhibit V, pages 97, 98 and 99.

† This line is an average for such of the tabulated diseases as were reported present in the given month or year.

DIAGRAM 1.—WEEKLY REPORTS OF DISEASES IN MICHIGAN, IN 1885.

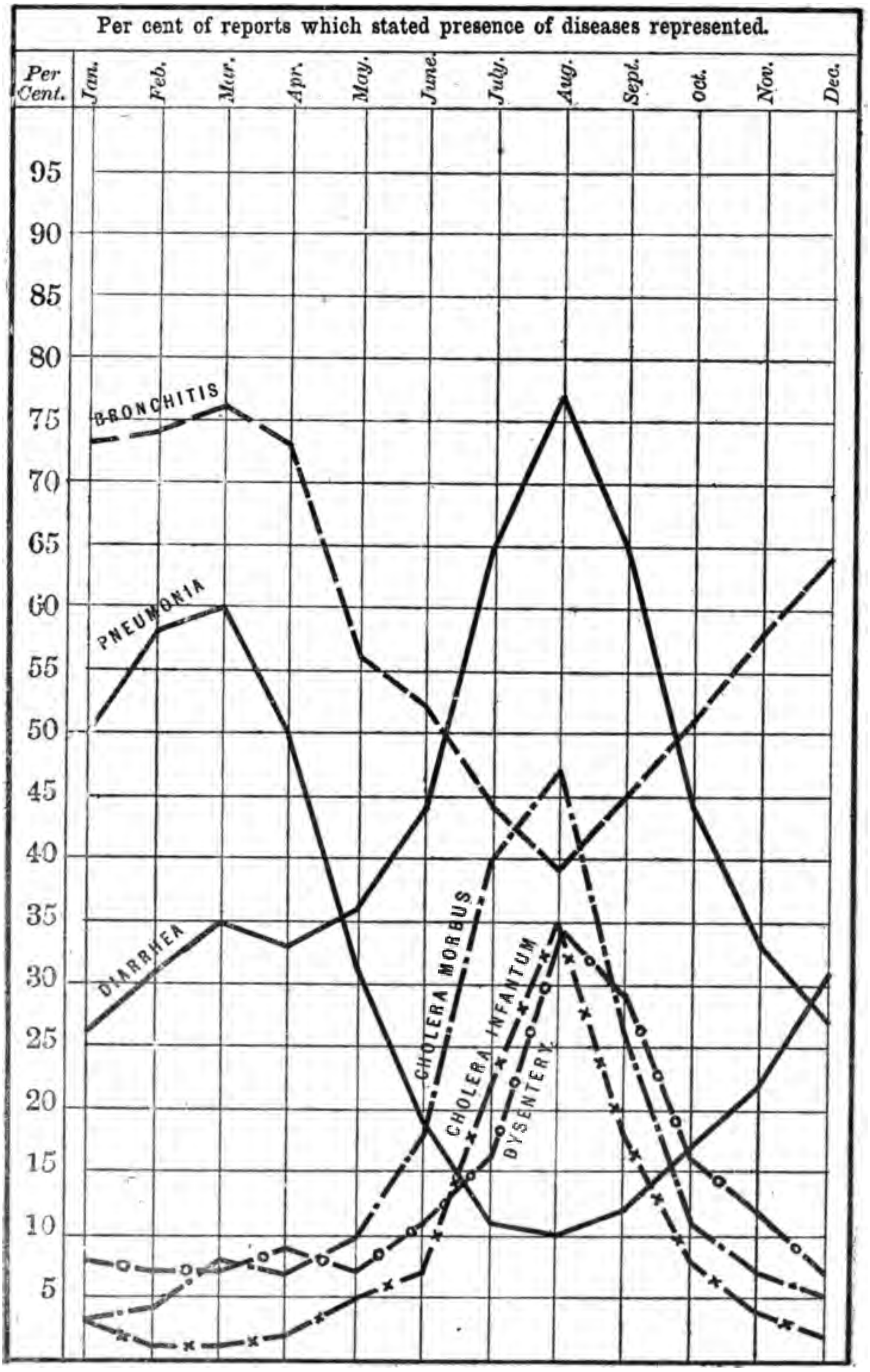


EXHIBIT III.—*Stating, by Months of the Year ending Saturday, January 2, 1886, for the State, and for each of the Eleven Geographical Divisions of Michigan from which Weekly Reports of Diseases were received, the Number of Observers from whom the Reports were received; the Number of Reports received; the day on which, for the purposes of this compilation, each month is made to end; and the Number of Weeks thus included in each Month.*

Months, 1885.	Months and Year End Saturday.	Number of Weeks.	State.		Divisions of the State.* 1. UpperPeninsular*		2. North-western.*		3. North-ern.*		4. North-eastern.*		5. Western*		6. Northern Central.*		7. Bay and Eastern.*		8. Central.*		9. South-western.*		10. Southern-Central.*		11. South-eastern.*	
			Observers.‡	Reports.†	Observers.‡	Reports.†	Observers.‡	Reports.†	Observers.‡	Reports.†	Observers.‡	Reports.†	Observers.‡	Reports.†	Observers.‡	Reports.†	Observers.‡	Reports.†	Observers.‡	Reports.†	Observers.‡	Reports.†	Observers.‡	Reports.†	Observers.‡	Reports.†
Year 1885......‡	Jan. 2, 1886.....	52	164	5,108	4	179	5	129	4	151	5	179	18	419	3	79	21	639	32	1,046	13	428	35	1,095	24	764
Av. per month.	....	..	104	426	4	15	3	11	3	13	4	15	8	35	2	7	13	53	21	87	9	36	22	91	15	64
January........	Jan. 31..........	4	72	280	3	12	4	15	3	11	2	8	6	24	2	8	7	28	16	62	4	16	16	61	9	35
February	Feb. 28..........	4	71	274	3	12	4	15	2	8	2	8	6	21	2	7	7	27	16	63	4	16	16	63	9	34
March..........	March 28.......	4	71	271	2	8	3	12	3	10	4	13	5	19	1	4	8	30	16	64	4	16	16	60	9	35
April...........	May 2..........	5	69	314	4	17	4	15	3	15	4	19	3	11	1	5	8	37	14	65	4	19	15	68	9	43
May........ ..	May 30.........	4	94	347	4	16	2	8	3	12	4	16	6	24	1	4	10	37	19	70	8	27	21	76	16	57
June	June 27.........	4	108	399	4	14	2	8	4	15	4	15	9	35	1	4	13	42	20	76	9	34	25	89	17	67
July............	Aug. 1..........	5	122	564	4	18	3	14	4	18	4	20	9	45	2	8	18	78	23	107	10	45	26	122	19	89
August........	Aug. 29..........	4	127	485	4	16	2	8	3	11	4	15	10	38	2	8	18	66	24	89	13	49	28	109	19	76
September.....	Oct. 3...........	5	128	601	4	20	2	8	2	10	3	15	12	55	2	8	19	84	25	121	11	54	29	136	19	90
October........	Oct. 31..........	4	133	495	4	15	2	8	4	14	4	16	12	46	2	7	18	69	26	96	13	49	27	100	21	75
November......	Nov. 28.........	4	130	498	4	16	2	8	3	12	4	15	12	47	2	6	19	71	27	106	12	48	25	93	20	76
December......	Jan. 2, 1886.....	5	121	580	3	15	2	10	3	15	4	19	11	54	2	10	15	70	27	127	12	55	24	118	18	87

* For counties in each division, see Exhibit I., page 87. † From some of the observers reports were not received for every week, so that the number of reports received does not equal the number of observers multiplied by the number of weeks in the given month or in the year.

‡ In some localities there were more observers than one. The whole number of localities from which reports were received was 135; the average number per month was 104. The names of observers and number of cards received from each observer for each month and for the year is stated in Exhibit V., pages 97, 98, 99.

EXHIBIT IV.—*Stating for each of 27 Diseases for the Nine Years ending Saturday, January 2, 1886, and for each of those years, on what Per Cent of the Reports received the diseases were stated to be present. Compiled from Weekly Reports by Health Officers of Cities and Villages and by Regular Correspondents of the State Board of Health.** (*Continued for each month of several of the above mentioned years on pages* 92. *and* 93.)

Line Number.	Diseases.	What Per Cent of Reports Received Stated the Presence of the Disease.									
		Average 1877-85.	1885.	1884.	1883.	1882.	1881.	1880.	1879.	1878.	1877.
	Average Disease†	30	26	29	30	30	33	32	33	30	28
1	Rheumatism	68	68	70	68	68	71	71	72	68	60
2	Neuralgia‡	66	68	70	69	68	65	64	59	......	......
3	Intermittent Fever	74	59	65	69	71	82	82	82	82	75
4	Consumption, Pulmonary‡	64	58	63	61	66	71	68	70	71	52
5	Bronchitis	62	56	61	66	65	62	64	64	64	55
6	Tonsilitis	49	50	50	50	48	48	49	45	......	......
7	Diarrhea	47	46	52	49	48	52	47	48	41	41
8	Remittent Fever‡	50	36	44	41	48	54	56	57	58	52
9	Influenza	41	34	41	43	40	35	42	45	44	41
10	Pneumonia	38	27	29	38	39	41	42	41	41	40
11	Erysipelas	23	24	26	25	22	23	25	25	21	20
12	Inflammation of Kidney‡	24	21	26	......	......	......	......	......	......	......
13	Cholera Morbus	19	17	22	18	17	26	20	19	14	15
14	Inflammation of Bowels‡	15	17	17	16	13	14	12	......	......	......
15	Typho-malarial Fever‡	23	16	20	18	24	29	24	22	24	26
16	Dysentery	19	15	23	21	17	23	18	18	19	21
17	Whooping-cough	20	14	23	15	17	16	32	23	21	21
18	Diphtheria	23	14	15	17	25	34	27	29	23	19
19	Scarlatina	19	12	16	19	18	19	15	23	25	21
20	Cholera Infantum	13	11	15	14	12	18	14	14	11	11
21	Typhoid Fever (Enteric)	13	8	12	11	14	18	14	12	10	14
22	Inflammation of Brain‡	6	6	7	6	5	5	6	......	......	......
23	Cerebo-spinal Meningitis	5	6	7	5	6	9	2	2	2	3
24	Puerperal Fever	5	6	7	7	7	5	3	3	3	4
25	Measles	13	5	10	24	11	26	19	12	5	7
26	Membranous Croup	7	5	6	6	7	9	6	7	7	6
27	Small-pox	1.2	0.2	0.1	0.3	3	2	0.4	0.4	0.2	4
	Number of reports received	4,014	5,108	3,957	4,458	4,745	3,567	3,991	3,755	3,221	3,320

* For 1885 the number of observers, reports, weeks in each month, etc., are stated in the first five columns of Exhibit III, page 90; the names of the observers and the number of the reports received from each are stated in Exhibit V, pages 97-99.

† The numbers opposite the names of the diseases do not state what per cent of the whole number of reports for the year stated the disease to be present at some time during the year, but state (on an average for twelve months of the year), what per cent of reports for the several months stated the disease to be present in those months. The column for each year is thus a statement for an average month of that year. On the two following pages of this table, however, the columns for each month state what per cent of the reports for that month (the number of which is stated at the foot of the column) stated the given disease to be present in that month.

‡ Consumption, remittent fever, and typho-malarial fever were not printed on the first blanks used in making weekly reports (beginning with the month of September, 1876); neuralgia and tonsilitis were not printed on any blanks used prior to October, 1878, and not on all used for several months after that date; inflammation of brain and inflammation of bowels were not printed on any blanks used prior to July, 1879, and not on all used for several months after that date; inflammation of kidney was not printed on any of the cards used prior to October, 1883, and not on all used for several months after that date; hence it is probable that these diseases were not so fully reported at first as were the other diseases.

EXHIBIT IV.—CONTINUED.—*Stating, for each of 27 Diseases by Months, on what Per Cent*

What Per Cent of the Reports Received Stated Presence of the Disease.

January.*

Line Number.	Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
	Av. Disease†	31	29	29	30	31	34
1	Neuralgia ‡	69	79	69	77	69	69
2	Bronchitis	77	73	71	77	73	86
3	Rheumatism	73	73	65	77	70	71
4	Tonsilitis	60	63	53	64	57	65
5	Consump., Pul. ‡	64	60	56	69	66	74
6	Influenza	57	58	55	51	48	57
7	Int'rmitt'nt Fever	60	51	56	56	59	67
8	Pneumonia	60	50	54	56	58	69
9	Remittent Fever‡	41	33	38	36	45	49
10	Erysipelas	27	32	23	29	25	30
11	Diarrhea	27	26	28	31	34	29
12	Infl. of Kidney ‡	27	26	28	...	...	...
13	Whooping-cough	21	18	21	14	18	20
14	Scarlatina	24	16	19	22	22	25
15	Mem. Croup	12	16	7	9	10	16
16	Typho-mal F. ‡	18	15	14	17	26	17
17	Infl. of Bowels ‡	13	14	12	13	14	11
18	Diphtheria	29	14	17	26	37	36
19	Typhoid Fever	12	11	10	11	21	13
20	Cer-spinal Men.	4	8	4	2	7	4
21	Inflam. of Brain ‡	5	8	7	2	4	4
22	Dysentery	7	8	10	9	6	5
23	Measles	11	4	16	18	10	19
24	Puerperal Fever	5	4	8	7	6	4
25	Cholera Morbus	4	3	5	6	5	4
26	Cholera Infantum	2	3	1	3	1	0
27	Small-pox	1.8	0	0	2	7	1
	Reports received§	344	280	385	444	387	276

February.*

Line Number.	Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
	Av. Disease†	31	29	29	31	30	34
1	Neuralgia ‡	63	79	73	75	67	75
2	Rheumatism	73	76	67	71	67	74
3	Bronchitis	78	74	71	80	70	86
4	Consump., Pul. ‡	66	68	61	66	68	76
5	Influenza	62	60	51	62	51	64
6	Tonsilitis	54	58	59	61	59	65
7	Pneumonia	65	58	49	62	63	73
8	Int. Fever	62	52	56	62	60	69
9	Erysipelas	27	35	24	34	22	28
10	Remittent Fev'r‡	40	32	40	32	39	45
11	Diarrhea	28	31	27	34	31	32
12	Infl. of Kidney ‡	29	27	31	...	...	...
13	Scarlatina	25	18	25	21	24	30
14	Typho-mal F. ‡	16	16	12	15	23	17
15	Infl. of Bowels ‡	13	16	12	13	14	13
16	Whooping-cough	20	16	21	14	19	16
17	Diphtheria	25	10	13	21	32	39
18	Mem. Croup	10	10	10	10	9	19
19	Cer-spinal Men.	5	9	7	5	8	3
20	Inflam. of Brain‡	6	7	7	5	5	5
21	Typhoid Fever	9	7	7	7	16	10
22	Measles	13	7	16	20	11	30
23	Dysentery	6	7	7	8	7	4
24	Puerperal Fever	5	5	9	5	9	6
25	Cholera Morbus	5	4	5	8	7	8
26	Cholera Infant.	1.6	1	3	3	1	1
27	Small-pox	1.3	1	0	1	5	0.4
	Reports rec'd §	305	274	306	357	398	277

March.*

Line Number.	Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
	Av. Disease†	31	30	30	33	30	32
1	Rheumatism	74	82	70	70	70	77
2	Neuralgia ‡	64	77	74	75	69	72
3	Bronchitis	77	76	71	82	75	80
4	Consump., Pul.‡	67	71	66	66	66	73
5	Tonsilitis	53	61	56	61	53	65
6	Pneumonia	62	60	43	64	60	62
7	Influenza	59	52	50	71	52	59
8	Interm't Fever	65	51	57	63	65	70
9	Remit'nt Fever‡	42	43	40	36	38	41
10	Erysipelas	28	35	24	30	22	29
11	Diarrhea	29	35	26	34	31	33
12	Infl. of Kidney‡	27	24	29	...	...	...
13	Whoop-cough	20	20	20	14	20	14
14	Infl. of Bowels ‡	15	20	17	12	14	15
15	Typho-mal F. ‡	14	14	13	13	19	13
16	Scarlatina	25	14	28	24	23	23
17	Cer-spinal Men.	6	12	9	6	8	5
18	Diphtheria	22	11	16	19	25	29
19	Measles	17	10	14	28	15	39
20	Puerperal Fever	7	10	10	7	6	6
21	Mem. Croup	8	10	5	6	8	13
22	Infl. of Brain ‡	7	9	8	6	4	6
23	Cholera Morbus	6	8	9	7	7	6
24	Dysentery	8	7	12	10	10	5
25	Typhoid Fever	7	5	8	7	12	7
26	Cholera Infant.	2	1	4	3	2	1
27	Small-pox	1	0.4	0	0	3	1
	Reports rec'd §	326	271	304	345	477	335

April.*

Line Number.	Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
	Av. Disease†	30	28	28	33	30	35
1	Rheumatism	75	79	75	80	71	82
2	Neuralgia ‡	73	75	76	78	73	72
3	Bronchitis	72	73	65	76	74	78
4	Consump., Pul. ‡	69	69	70	65	66	76
5	Intermit'nt Fever	73	57	65	68	68	84
6	Tonsilitis	53	53	53	58	52	56
7	Pneumonia	55	50	39	55	58	61
8	Influenza	52	41	49	60	47	52
9	Remittent Fever‡	45	38	42	41	44	52
10	Diarrhea	32	33	38	38	41	33
11	Erysipelas	28	29	25	31	25	25
12	Infl. of Kidney ‡	24	22	26	...	...	...
13	Whooping-cough	18	17	16	16	15	11
14	Infl. of Bowels ‡	13	17	11	17	12	8
15	Diphtheria	21	16	12	16	26	32
16	Scarlatina	23	13	22	23	19	27
17	Inflam. of Brain ‡	7	11	6	7	7	7
18	Typho-mal-F. ‡	12	10	11	12	18	9
19	Measles	23	10	14	45	13	61
20	Dysentery	9	9	10	9	13	3
21	Cer-spi-Men.	7	8	10	7	9	18
22	Puerperal Fever	4.4	8	6	7	4	4
23	Cholera Morbus	6	7	6	8	8	9
24	Mem. Croup	7	6	4	7	7	9
25	Typhoid Fever	6	4	6	7	8	5
26	Cholera Infantum	2.3	2	6	5	1	0
27	Small-pox	1.8	0 3	0.3	0	5	4
	Reports received§	296	314	321	332	336	267

May.*

Line Number.	Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
	Av. Disease†	28	25	28	31	29	31
1	Rheumatism	71	74	77	77	65	74
2	Neuralgia ‡	67	67	74	73	71	64
3	Intermit'nt Fev'r	81	64	68	74	76	88
4	Consump., Pul. ‡	66	58	67	62	69	69
5	Bronchitis	61	56	59	70	70	62
6	Tonsilitis	47	50	52	54	47	41
7	Diarrhea	36	36	45	38	39	38
8	Remit. Fever ‡	48	33	40	42	49	57
9	Influenza	39	31	42	50	40	30
10	Pneumonia	40	31	24	46	46	51
11	Erysipelas	26	27	27	27	23	22
12	Infl. of Kidney ‡	26	22	29	...	...	...
13	Infl. of Bowels ‡	12	18	12	16	9	7
14	Scarlatina	20	13	25	22	15	23
15	Typho-mal-F. ‡	12	11	12	15	15	13
16	Cholera Morbus	8	10	7	11	5	13
17	Measles	27	9	17	51	21	62
18	Whooping-cough	19	9	21	17	14	15
19	Diphtheria	18	9	17	15	22	33
20	Dysentery	9	7	11	11	7	5
21	Puerperal Fever	5	6	6	7	9	6
22	Cer-spi-Men.	6.3	6	6	6	7	20
23	Infl. of Brain ‡	6	5	6	6	6	5
24	Cholera Infant.	3.2	5	5	6	2	3
25	Typhoid Fever	5	3	5	6	7	6
26	Mem. Croup	5	3	5	6	6	5
27	Small-pox	2.6	1	1	2	7	7
	Reports rec'd §	327	347	281	417	459	274

June.*

Line Number.	Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
	Av. Disease†	28	24	29	29	28	30
1	Rheumatism	67	71	73	69	69	71
2	Intermit. Fever	83	68	72	73	76	91
3	Neuralgia ‡	65	67	67	68	69	63
4	Consump., Pul.‡	65	61	65	61	66	68
5	Bronchitis	54	52	56	62	62	53
6	Diarrhea	46	44	52	49	45	55
7	Tonsilitis	42	43	45	41	43	40
8	Remit. Fever ‡	50	35	43	46	44	55
9	Erysipelas	24	24	24	27	22	23
10	Influenza	28	23	30	33	33	19
11	Infl. of Kidney ‡	24	21	27	...	...	...
12	Pneumonia	26	19	18	27	34	28
13	Infl. of Bowels ‡	16	18	18	16	14	14
14	Cholera Morbus	18	18	26	16	13	26
15	Scarlatina	17	15	14	18	22	19
16	Diphtheria	16	12	13	14	17	26
17	Dysentery	14	11	17	17	9	18
18	Typho-mal-F. ‡	13	10	12	14	9	6
19	Whoop-cough	20	10	22	13	15	15
20	Cholera Infant.	10	7	14	9	9	17
21	Measles	22	7	13	42	21	44
22	Infl. of Brain ‡	6	7	8	6	6	4
23	Puerperal Fever	5	5	7	6	10	4
24	Cer-spi-Men.	5	5	6	6	8	11
25	Typhoid Fever	6	5	4	7	9	6
26	Mem. Croup	4	3	4	5	4	5
27	Small-pox	2	1	0	1	5	4
	Reports rec'd §	317	399	301	343	343	337

* For 1885 the number of observers, reports, weeks in each month, etc., are stated in the first five columns of Exhibit III., page 90; the names of observers and the number of reports received from each are stated in Exhibit V., pages 97–99.

† The numbers in this line are an average, not for all diseases represented, but only for those reported present in the given month. ‡ See foot-note with this mark on page 91.

§ The numbers in this line state how many reports were received for the month in the given year.

of the Reports Received the Diseases were stated to be Present in the Year 1881-85.

What Per Cent of the Reports Received Stated Presence of the Disease.

July.*

Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
Av. Disease†	30	26	31	29	28	34
Intermitt. Fever	84	67	76	78	77	92
Diarrhea	73	65	73	66	60	91
Rheumatism	61	63	67	64	66	65
Neuralgia ‡	60	61	68	64	64	55
Consump., Pul. ‡	62	56	63	59	67	67
Bronchitis	43	44	49	56	51	38
Cholera Morbus	47	40	44	37	32	74
Tonsilitis	33	38	38	36	35	61
Remitt'nt Fever ‡	53	32	50	43	47	58
Cholera Infant.	31	22	29	28	17	51
Erysipelas	21	21	28	20	21	17
Infl. of Kidney ‡	21	18	24	...	...	...
Influenza	21	18	27	24	21	9
Infl. of Bowels ‡	17	16	20	16	13	20
Dysentery	32	16	36	25	21	56
Whooping-cough	22	14	28	12	19	21
Diphtheria	15	14	8	15	16	25
Scarlatina	14	13	12	17	14	16
Pneumonia	17	11	16	16	17	18
Typho-mal. F. ‡	16	10	14	11	14	18
Cer.-spi. Men.	4	8	5	7	4	8
Measles	15	8	5	26	17	26
Inflam. of Brain ‡	6	6	8	6	3	8
Puerperal Fever	4	5	6	6	10	5
Typhoid Fever	7	5	7	6	8	12
Mem. Croup	2.2	2	4	3	3	4
Small-pox	1.6	0	0	0.3	4	3
Reports received§	353	564	407	371	346	276

August.*

Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
Av. Disease†	33	27	34	32	30	37
Diarrhea	86	77	88	82	78	95
Intermitt. Fever.	84	65	73	77	80	94
Rheumatism	57	59	68	57	61	65
Neuralgia ‡	57	58	64	59	61	54
Consump., Pul. ‡	59	52	63	55	63	67
Cholera Morbus.	57	47	52	51	52	84
Remitt'nt Fever‡	60	39	47	48	55	63
Bronchitis	41	39	47	53	44	37
Tonsilitis	32	37	38	35	31	26
Cholera Infant.	48	35	43	45	41	69
Dysentery	55	34	50	50	40	80
Infl. of Bowels ‡	21	20	24	25	13	21
Infl. of Kidney ‡	21	19	23	...	...	...
Influenza	22	18	30	21	19	16
Erysipelas	19	16	28	19	19	16
Whooping-cough	22	16	29	14	20	18
Typho-mal. F. ‡	25	15	23	21	21	30
Diphtheria	16	13	14	13	14	29
Pneumonia	14	10	11	16	12	14
Scarlatina	12	8	12	13	10	12
Typhoid Fever	13	6	14	11	11	23
Cer.-spi. Men.	5	6	10	4	6	7
Infl. of Brain ‡	7	6	9	6	5	9
Puerperal Fever.	5	5	8	8	5	7
Measles	7	2	4	12	6	16
Mem. Croup	2.5	1	4	4	3	4
Small-pox	0.7	0	0	0	1	1
Reports rec'd §	362	485	315	475	495	329

September.*

Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.	Line Number.
Av. Disease†	33	27	34	32	34	36	
Diarrhea	81	65	88	77	80	90	1
Intermit. Fever.	84	65	73	76	82	92	2
Neuralgia ‡	61	64	63	62	64	57	3
Rheumatism	60	60	67	55	62	63	4
Consump., Pul.‡	61	54	63	57	63	70	5
Bronchitis	49	45	50	53	57	44	6
Tonsilitis	37	42	39	43	37	30	7
Remit'nt Fever‡	62	40	53	52	61	66	8
Influenza	29	30	34	26	33	17	9
Dysentery	49	29	60	53	42	62	10
Cholera Morbus	39	26	51	37	38	58	11
Typho-mal. F. ‡	41	24	33	32	40	57	12
Cholera Infant.	36	18	47	34	40	51	13
Erysipelas	17	17	24	19	18	15	14
Infl. of Kidney ‡	20	17	22	...	...	...	15
Whoop.-cough	22	16	22	14	20	18	16
Diphtheria	19	15	10	12	23	33	17
Infl. of Bowels ‡	16	13	25	18	14	13	18
Pneumonia	17	12	10	21	19	19	19
Typhoid Fever	21	11	19	19	17	35	20
Scarlatina	13	7	9	16	12	11	21
Cer.-spi. Men.	5	6	7	7	7	7	22
Infl. of Brain ‡	7	5	8	6	6	7	23
Puerperal Fever	5	4	7	6	7	5	24
Mem. Croup	4	3	5	5	5	5	25
Measles	5	2	4	9	3	8	26
Small-pox	0.4	0	0	0	0	0.4	27
Reports rec'd §	341	601	302	361	381	255	

October.*

Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
Av. Disease†	32	26	33	29	32	35
Rheumatism	66	64	67	62	70	69
Neuralgia ‡	63	62	68	64	64	58
Intermitt. Fever.	81	60	72	71	80	91
Consump., Pul. ‡	64	55	65	58	65	73
Bronchitis	55	51	56	57	59	44
Tonsilitis	45	48	48	48	45	40
Diarrhea	57	44	70	51	66	70
Remitt'nt Fever ‡	60	39	54	45	60	69
Influenza	33	31	37	35	40	18
Typho-mal. F. ‡	45	25	39	29	47	70
Infl. of Kidney ‡	24	21	26	...	...	...
Diphtheria	27	19	18	15	28	44
Erysipelas	21	18	27	24	26	18
Infl. of Bowels ‡	14	17	17	15	16	12
Pneumonia	23	17	21	23	25	21
Dysentery	25	16	44	20	28	31
Whooping-cough.	19	15	15	14	16	13
Typhoid Fever	23	13	23	21	23	37
Scarlatina	16	13	9	17	15	13
Cholera Morbus	16	11	29	14	17	23
Cholera Infant.	13	8	22	14	20	18
Puerperal Fever	5	5	6	5	8	6
Cer.-spi. Men.	4	5	5	4	3	8
Inflam. of Brain ‡	5	5	5	5	4	4
Mem. Croup	5	3	7	5	9	6
Measles	5	1	4	10	4	5
Small-pox	0.4	0	0	0	2	0
Reports received §	361	495	362	422	358	254

November.*

Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
Av. Disease†	30	26	30	29	31	32
Rheumatism	72	70	70	69	71	72
Neuralgia ‡	68	67	73	65	74	67
Tonsilitis	55	58	58	55	54	52
Bronchitis	67	58	68	61	71	66
Consump., Pul. ‡	65	56	60	58	63	74
Intermitt. Fever.	72	55	61	62	69	83
Remitt'nt Fever‡	50	38	43	39	51	56
Influenza	42	37	41	39	44	34
Diarrhea	36	33	46	41	40	38
Erysipelas	23	26	28	24	23	21
Pneumonia	35	22	29	34	33	36
Typho-mal. F. ‡	34	21	33	24	37	61
Infl. of Kidney ‡	22	19	25	...	...	...
Infl. of Bowels ‡	14	16	17	17	14	12
Typhoid Fever	22	16	23	17	23	32
Diphtheria	30	16	19	22	28	42
Whooping-cough	20	14	14	17	16	17
Dysentery	12	12	15	16	14	9
Scarlatina	18	11	10	22	19	13
Puerperal Fever.	5	7	6	5	10	4
Cholera Morbus.	7	7	12	6	7	10
Inflam. of Brain‡	5	5	8	6	4	4
Mem. Croup	9	5	10	7	10	11
Cholera Infant.	4	4	7	5	5	4
Measles	6	3	4	14	7	3
Cer.-spi. Men.	3	2	4	4	4	7
Small-pox	0.8	0	0	0	2	2
Reports rec'd §	331	498	301	298	430	337

December.*

Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.	Line Number.
Av. Disease†	30	26	29	28	29	31	
Neuralgia ‡	70	73	73	68	72	67	1
Rheumatism	74	70	76	70	74	71	2
Bronchitis	72	64	70	69	71	68	3
Tonsilitis	60	60	57	54	65	61	4
Consump., Pul. ‡	64	56	58	60	65	67	5
Intermit. Fever.	63	49	53	60	61	69	6
Influenza	49	40	49	47	52	42	7
Pneumonia	46	39	34	44	47	47	8
Remit'nt Fever‡	44	31	40	32	42	47	9
Erysipelas	24	28	26	22	24	28	10
Diarrhea	28	27	35	30	29	30	11
Infl. of Kidney ‡	24	20	27	...	...	...	12
Diphtheria	29	17	20	15	28	40	13
Infl. of Bowels ‡	14	17	16	14	16	14	14
Typho-mal. F.	23	14	23	15	23	40	15
Whoop.-cough	20	13	17	19	13	16	16
Scarlatina	19	11	15	17	18	16	17
Typhoid Fever	16	8	13	14	16	25	18
Puerperal Fever	5	7	7	9	5	6	19
Dysentery	7	7	8	11	8	3	20
Infl. of Brain ‡	5	6	5	8	5	3	21
Mem. Croup	10	5	10	7	9	11	22
Cholera Morbus	5	5	9	5	5	5	23
Cer.-spi. Men.	4	4	8	3	3	7	24
Measles	7	3	4	12	10	3	25
Cholera Infant.	2	2	3	3	1	1	26
Small-pox	0.8	0	0	0	1	5	27
Reports rec'd §	352	580	372	293	335	350	

*, †, ‡. See notes with these marks on page 91.
§ For this foot-note see page 92.

TABLE 1.—CONTINUED.ª—*Per Cents of Observers by whom the several*

Per Cent of Observers by whom Diseases were Reported Present.

Line Number.	January.*							February.*							March.*						
	Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.	Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.	Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
	Average.......†	42	38	41	44	43	44	Average. ......†	41	38	40	42	42	44	Average. ......†	42	40	41	44	44	46
1	Neuralgia........‡	84	89	84	96	86	81	Neuralgia ......‡	84	89	84	91	82	83	Neuralgia.......‡	87	87	84	91	87	90
2	Rheumatism......	88	85	81	96	86	83	Rheumatism....	85	86	81	84	82	87	Rheumatism....	86	87	82	80	89	93
3	Bronchitis.........	87	82	83	90	86	90	Bronchitis.......	87	85	81	90	83	90	Bronchitis.......	87	85	80	91	85	90
4	Tonsilitis...........	80	78	79	87	81	81	Tonsilitis........	79	82	79	82	76	76	Consump., Pul‡	76	80	75	75	74	84
5	Pneumonia.	80	69	79	80	76	86	Pneumonia	82	73	73	78	85	91	Tonsilitis.........	79	77	77	82	76	82
6	Influenza...........	70	67	69	66	65	67	Consump., Pul‡	74	72	65	80	79	84	Pneumonia.	80	75	63	83	84	78
7	Consumpt'n, Pul‡	73	64	65	80	73	79	Influenza.........	72	69	64	74	63	71	Influenza.........	70	63	61	82	66	70
8	Intermittent F...	75	60	71	76	75	80	Intermittent F..	75	65	65	77	78	79	Intermittent F..	78	63	73	76	84	85
9	Erysipelas	48	49	51	54	45	49	Erysipelas.	45	55	44	53	38	49	Erysipilas	46	54	42	47	44	55
10	Remittent F......‡	56	43	58	57	61	56	Diarrhea..........	43	49	48	52	46	51	Remittent F...‡	56	52	53	54	51	57
11	Diarrhea............	46	40	51	54	58	44	Remittent F...‡	53	45	53	47	55	56	Diarrhea..........	48	52	46	49	59	55
12	Infl. of Kidney..‡	40	35	45	..	..	..	Infl. of Kidney.‡	43	39	46	..	..	..	Infl. of Kidney.‡	41	41	41	..	..	..
13	Membr. Croup.....	26	29	19	21	20	30	Infl. of Bowels.‡	25	31	21	29	26	27	Infl. of Bowels.‡	29	31	27	24	32	28
14	Scarlatina	39	28	34	40	34	40	Scarlatina........	39	30	40	33	39	44	Whoop.-cough..	27	28	29	20	29	22
15	Whooping-cough.	30	24	34	22	27	30	Typho-mal. F...	25	27	19	26	39	27	Scarlatina........	40	24	39	40	41	48
16	Typho-mal. F....‡	31	24	25	32	46	30	Whoop.-cough..	27	20	30	23	25	23	Typho-mal F...‡	22	21	15	21	31	22
17	Diphtheria..........	46	22	35	43	56	56	Diphtheria.......	40	20	20	39	49	60	Diphtheria.......	38	20	25	34	45	51
18	Infl. of Bowels...‡	25	21	24	30	26	19	Mem. Croup.....	20	18	19	19	19	33	Mem. Croup.....	18	18	11	16	21	25
19	Typhoid Fever.....	20	18	19	21	35	20	Cer.-spinal Men	9	14	14	11	15	7	Infl. of Brain...‡	14	18	16	10	11	16
20	Infl. of Brain.....‡	12	15	19	7	9	9	Infl. of Brain...‡	13	13	14	11	14	10	Cer.-spinal Men	11	18	14	13	16	13
21	Dysentery	16	15	21	24	14	11	Dysentery	12	13	11	14	14	7	Cholera Morbus	14	18	18	16	16	16
22	Cholera Infantum	5	10	3	9	4	10	Typhoid Fever..	15	11	13	9	27	16	Puerperal F.....	15	17	18	16	17	16
23	Cer.-spinal Men..	7	10	13	3	13	15	Measles.	21	10	29	32	19	44	Dysentery	16	17	20	21	21	12
24	Cholera Morbus..	10	10	11	18	12	11	Cholera Morbus	12	8	13	16	13	17	Measles...........	27	14	25	43	29	55
25	Puerperal Fever..	13	8	18	16	13	11	Puerperal F.....	11	7	16	13	22	13	Typhoid Fever..	12	10	16	10	17	13
26	Measles.	18	7	26	33	18	27	Cholera Infant..	4	3	5	8	4	4	Cholera Infant.	5	3	5	7	5	4
27	Small-pox	3	0	0	2	9	3	Small-pox	2	1	0	2	9	1	Small-pox	1	1	0	0	6	1
	Observers.. ......§	77	72	80	90	97	70	Observers.......§	78	71	80	90	100	70	Observers.......§	77	71	79	87	98	67

Line Number.	April.*							May.*							June.*						
	Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.	Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.	Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
	Average..........†	42	39	43	45	42	47	Average.........†	41	36	40	45	43	44	Average.........†	40	35	39	41	41	45
1	Rheumatism......	88	90	88	93	85	93	Rheumatism....	86	87	89	89	84	89	Rheumatism....	84	84	86	85	87	86
2	Neuralgia.........‡	87	88	91	93	90	84	Neuralgia.......‡	82	83	89	86	91	81	Neuralgia.......‡	81	81	81	85	83	78
3	Bronchitis.	84	80	82	85	90	88	Intermittent F..	89	77	81	85	87	94	Intermittent F..	89	75	79	89	86	96
4	Consumpt'n, Pul‡	76	80	76	71	78	79	Tonsilitis.........	71	74	80	78	72	60	Consump., Pul‡	71	70	74	69	74	72
5	Intermittent F....	84	72	82	79	81	91	Bronchitis.......	78	72	76	89	86	80	Bronchitis.	69	69	69	75	77	72
6	Pneumonia..........	77	72	69	75	81	79	Consump., Pul‡	77	71	74	77	79	79	Tonsilitis.........	65	65	67	60	69	64
7	Tonsilitis............	75	70	78	81	71	75	Diarrhea..........	56	56	68	63	62	54	Diarrhea..........	65	62	65	69	61	80
8	Influenza............	64	61	60	73	60	66	Influenza.........	54	46	55	64	55	49	Remittent F...‡	64	50	50	59	60	65
9	Remittent F.... ‡	60	51	65	55	64	62	Remittent F...‡	62	46	53	56	65	67	Erysipelas.	42	41	48	50	41	42
10	Diarrhea............	50	51	66	53	65	54	Erysipelas.......	48	46	47	54	49	40	Cholera Morbus	40	37	48	31	28	64
11	Erysipelas.	47	49	54	51	45	44	Pneumonia.	65	42	47	76	73	83	Pneumonia.......	45	35	33	43	57	54
12	Infl. of Kidney....	41	35	47	..	..	..	Infl. of Kidney.‡	39	36	42	..	..	..	Influenza.........	40	33	38	48	53	30
13	Infl. of Bowels.....	25	33	26	32	23	16	Infl. of Bowels.‡	27	34	26	31	21	20	Infl. of Bowels.‡	29	33	30	31	21	30
14	Infl. of Brain......	16	26	15	15	15	15	Scarlatina........	33	23	43	36	35	37	Infl. of Kidney.‡	38	32	43	..	..	..
15	Scarlatina...........	37	26	46	35	36	46	Cholera Morbus	20	22	18	24	16	29	Diphtheria.......	29	24	21	28	33	45
16	Whooping-cough.	26	25	31	24	21	22	Typho-mal. F..‡	21	21	22	31	23	24	Scarlatina........	29	22	26	28	34	30
17	Measles.	34	20	26	56	22	81	Measles.	39	18	30	71	37	80	Typho-mal. F..‡	23	20	25	26	21	19
18	Diphtheria.........	36	20	28	32	43	49	Diphtheria.......	30	16	32	28	38	43	Dysentery	26	18	27	32	16	36
19	Dysentery	16	20	21	16	26	7	Whoop-cough...	29	14	31	30	25	26	Whoop-cough ..	28	15	31	19	26	28
20	Cholera Morbus..	14	17	15	16	17	22	Infl. of Brain..‡	14	14	12	13	16	13	Cholera Infant..	23	15	23	18	22	39
21	Puerperal Fever..	10	17	15	13	9	9	Dysentery	17	14	18	24	16	11	Infl. of Brain..‡	12	15	12	11	16	7
22	Typho-mal. F......	21	16	22	22	28	18	Puerperal F.....	12	13	14	20	21	13	Measles	33	12	20	60	33	62
23	Cer.-spinal Men...	14	16	22	14	15	34	Cer.-spinal Men	11	12	12	11	14	26	Puerperal F.....	12	12	15	13	25	12
24	Membr. Croup.....	15	13	10	19	14	13	Cholera Infant.	8	12	11	13	6	10	Cer.-spinal Men	10	11	7	10	14	20
25	Typhoid Fever....	11	10	13	12	15	7	Typhoid Fover..	10	10	9	13	13	9	Typhoid Fever..	11	9	7	17	16	12
26	Cholera Infantum	4	3	12	9	2	0	Mem. Croup.....	11	7	12	16	13	11	Mem. Croup.....	8	6	7	14	7	13
27	Small-pox..........	3	1	1	0	6	9	Small-pox	4	1	1	1	11	7	Small-pox	3	1	0	1	6	6
	Observers.........§	72	69	68	85	86	68	Observers.......§	77	94	74	87	95	70	Observers.......§	79	108	84	88	87	69

* For 1885 the number of observers, reports, weeks in each month, etc., are stated in the first five columns of Exhibit III, page 90; the names of observers and the number of reports received from each are stated in Exhibit V, pages 97–99.

† The numbers in this line are an average, not for all diseases represented, but only for those reported present in the given month. ‡ See foot-note with this mark on page 91.

§ The numbers in this line state how many observers reported for the month in the given year.

ª For first part of Table 1, and full heading, see page 96.

Diseases were reported Present, by months in each of the years 1881–85.

Per Cent of Observers by whom the Diseases were Reported Present.

July.*

Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
Average……†	42	40	45	42	41	46
Diarrhea	91	89	93	87	82	97
Rheumatism	78	82	79	80	84	80
Intermittent F.	91	80	87	87	86	97
Neuralgia……‡	77	80	82	81	84	69
Cholera Morbus	71	70	72	60	53	87
Consump., Pul‡	70	65	74	68	77	74
Tonsilitis	55	61	61	66	61	43
Bronchitis	59	57	66	73	66	53
Remittent F……‡	68	50	66	58	67	71
Erysipelas	41	44	59	41	39	40
Cholera Infant.	48	39	48	44	28	70
Infl. of Bowels‡	34	34	36	27	32	39
Infl. of Kidney‡	36	33	39	..	..	..
Dysentery	52	30	55	45	36	74
Diphtheria	29	28	20	26	31	43
Influenza	32	27	39	35	31	19
Pneumonia	33	25	32	29	36	36
Scarlatina	25	23	25	29	24	27
Whoop-cough	31	21	37	22	31	27
Typho-mal. F……‡	28	20	28	24	22	27
Cer.-spinal Men	9	17	9	15	6	16
Infl. of Brain……‡	13	16	14	15	5	19
Puerperal F.	11	15	17	16	19	9
Measles	25	15	16	42	31	37
Typhoid Fever	14	13	13	13	15	21
Mem. Croup	5	4	7	7	6	9
Small-pox	3	0	0	1	5	4
Observers……§	82	122	87	95	88	70

August.*

Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
Average……†	44	40	39	48	45	48
Diarrhea	97	96	96	97	96	99
Intermittent F.	91	80	85	91	88	97
Rheumatism	73	76	81	76	79	82
Neuralgia……‡	73	72	74	82	82	67
Cholera Morbus	78	69	70	74	80	100
Consump., Pul‡	67	61	73	64	73	72
Dysentery	75	59	70	71	65	93
Cholera Infant.	67	58	62	64	69	85
Remittent F……‡	73	57	64	62	69	76
Tonsilitis	54	57	57	63	60	39
Bronchitis	55	51	64	70	65	49
Infl. of Bowels‡	35	39	36	43	30	34
Influenza	34	32	40	36	35	28
Infl. of Kidney‡	32	31	32	..	...	...
Erysipelas	35	31	46	44	41	27
Typho-mal. F……‡	42	26	39	38	39	54
Diphtheria	30	25	24	30	33	48
Whoop-cough	31	23	35	23	31	28
Pneumonia	26	21	21	39	29	27
Scarlatina	22	15	20	27	22	27
Typhoid Fever	23	13	23	21	24	33
Puerperal F.	11	13	17	19	17	13
Infl. of Brain……‡	16	13	17	17	14	21
Cer.-spinal Men	9	12	13	7	13	12
Measles	13	3	10	22	12	28
Mem. Croup	6	2	7	8	7	9
Small-pox	1	0	0	0	3	1
Observers……§	85	127	84	98	101	67

September.*

Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.	Line Number.
Average……†	46	43	46	46	48	46	
Diarrhea	95	88	94	95	95	97	1
Intermittent F.	91	85	86	86	89	95	2
Neuralgia……‡	74	78	80	75	80	67	3
Rheumatism	75	78	75	75	77	76	4
Tonsilitis	60	70	65	67	59	45	5
Bronchitis	63	66	61	68	75	53	6
Consump., Pul‡	68	66	71	64	71	77	7
Remittent F……‡	76	63	74	67	77	77	8
Dysentery	71	57	76	77	68	80	9
Cholera Morbus	65	55	71	63	66	82	10
Influenza	44	49	48	41	51	27	11
Cholera Infant.	58	45	68	53	67	71	12
Typho-mal. F……‡	58	41	50	51	56	74	13
Erysipelas	32	39	41	34	34	26	14
Diphtheria	33	31	21	23	42	47	15
Pneumonia	32	30	19	39	35	32	16
Infl. of Kidney‡	30	28	31	..	..	..	17
Infl. of Bowels‡	30	27	40	29	28	26	18
Whoop-cough	29	23	28	22	30	23	19
Typhoid Fever	31	21	29	29	27	45	20
Scarlatina	22	16	16	26	22	20	21
Cer.-spinal Men	10	15	13	15	13	12	22
Infl. of Brain……‡	13	12	16	11	11	12	23
Puerperal F.	11	12	16	10	19	11	24
Mem. Croup	9	8	9	11	11	12	25
Measles	9	3	8	14	6	11	26
Small-pox	1	0	0	0	0	2	27
Observers……§	83	128	80	92	96	66	

October.*

Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
Average……†	45	38	48	43	46	45
Neuralgia……‡	80	78	84	82	80	72
Rheumatism	83	77	85	80	85	80
Intermittent F.	89	74	84	86	88	94
Tonsilitis	68	71	73	70	73	52
Bronchitis	72	68	72	73	79	54
Diarrhea	79	67	91	73	87	85
Consump., Pul‡	74	63	80	69	73	78
Remittent F.	73	53	70	60	74	75
Influenza	47	43	50	48	55	28
Infl. of Kidney‡	40	38	42	..	..	..
Typho-mal. F……‡	61	36	57	41	69	77
Erysipelas	40	36	50	51	44	35
Diphtheria	44	34	30	31	48	55
Pneumonia	41	33	43	44	44	32
Infl. of Bowels‡	30	32	34	35	34	25
Dysentery	47	28	73	40	48	57
Cholera Morbus	33	24	55	31	35	45
Typhoid Fever	35	23	40	36	33	52
Whoop-cough	27	22	23	23	23	18
Scarlatina	27	22	18	26	32	15
Cholera Infant.	27	17	42	27	34	35
Infl. of Brain……‡	11	10	11	9	11	18
Puerperal F.	11	10	14	11	22	11
Mem. Croup	14	8	15	11	21	15
Cer.-spinal Men	10	8	11	11	8	17
Measles	8	2	7	18	8	8
Small-pox	1	0	0	0	2	0
Observers……§	78	133	74	88	91	65

November.*

Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.
Average……†	41	38	42	42	45	45
Rheumatism	84	83	83	78	88	84
Neuralgia……‡	82	82	87	78	94	81
Tonsilitis	77	80	79	75	82	77
Bronchitis	79	72	79	75	85	80
Intermittent F.	84	69	74	75	85	96
Consump., Pul‡	73	65	67	70	72	81
Remittent F……‡	65	55	58	55	67	73
Diarrhea	56	53	67	58	64	56
Influenza	56	51	51	53	65	53
Erysipelas	40	45	45	45	39	40
Pneumonia	56	39	45	57	65	59
Typho-mal. F……‡	47	34	45	40	57	76
Infl. of Kidney‡	35	32	38	..	...	...
Diphtheria	46	32	33	34	47	61
Typhoid Fever	32	28	33	23	41	46
Infl. of Bowels‡	27	28	27	30	31	30
Whoop.-cough	27	21	19	22	26	24
Scarlatina	29	21	17	34	31	20
Dysentery	23	20	33	30	30	21
Cholera Morbus	15	15	24	16	16	23
Puerperal F.	12	12	12	13	20	13
Infl. of Brain……‡	12	11	14	16	11	12
Mem. Croup	19	11	21	16	22	24
Cholera Infant.	10	8	18	12	11	13
Measles	10	6	6	22	14	6
Cer.-spinal Men	7	5	9	10	11	14
Small-pox	1	0	0	0	2	6
Observers……§	81	130	78	77	88	77

December.*

Diseases.	Av. '77-'85.	1885.	1884.	1883.	1882.	1881.	Line Number.
Average……†	41	39	44	39	40	42	
Neuralgia……‡	84	87	90	79	88	81	1
Rheumatism	86	86	90	84	90	82	2
Tonsilitis	81	83	82	69	83	83	3
Bronchitis	84	80	82	76	82	82	4
Intermittent F.	77	68	74	75	71	82	5
Consump., Pul‡	72	67	69	69	70	74	6
Diarrhea	46	55	60	48	48	45	7
Influenza	61	55	64	63	58	59	8
Erysipelas	42	54	45	37	40	53	9
Pneumonia	68	52	61	65	67	65	10
Remittent F……‡	59	50	64	45	58	59	11
Infl. of Kidney‡	38	34	42	..	..	..	12
Infl. of Bowels‡	27	34	34	25	33	24	13
Diphtheria	46	33	38	25	46	56	14
Whoop.-cough	27	23	25	27	23	18	15
Typho-mal. F……‡	36	23	39	27	37	60	16
Scarlatina	33	21	30	27	32	32	17
Puerperal F.	11	17	17	17	13	16	18
Infl. of Brain	11	16	9	13	11	8	19
Dysentery	15	15	19	19	12	8	20
Typhoid Fever	24	14	23	20	24	36	21
Cholera Morbus	13	12	23	19	15	11	22
Mem. Croup	22	10	27	15	17	25	23
Measles	14	8	6	35	18	9	24
Cer.-spinal Men	8	8	14	5	6	14	25
Cholera Infant.	5	6	10	7	5	2	26
Small-pox	2	0	0	0	2	10	27
Observers……§	81	121	77	75	84	88	

*, †, ‡. See notes with these marks on page 94.
§ For this foot-note see page 94.

TABLE 1.—*Stating, for each of the Nine Years 1877-1885, and the Average for 1877-1885, by what Per Cent of Observers each of 27 Diseases was reported present in those Years (also the Average Number of Observers per Month and the Total Observers for each Year).—Compiled from Weekly Reports of Health Officers of Cities and Villages and from Regular Correspondents of the State Board of Health.*—Diseases arranged in order of Greatest Number of Observers reporting them present in 1885.—(Continued, for each Month of several of the above mentioned Years, on pages 94 and 95.)*

Line Number.	Diseases.	Observers by whom the Several Diseases were Reported Present.—Average Per Cents† (per month) of those making Reports.									
		Av. 1877-85.	1885.	1884.	1883.	1882.	1881.	1880.	1879.	1878.	1877.
	Av'age for Tabulated Diseases Reported Present	42	38	42	43	43	45	43	44	39	38
1	Neuralgia	81	83	84	85	85	78	79	75	......	......
2	Rheumatism	83	83	83	83	85	84	85	85	81	78
3	Intermittent Fever	85	73	79	82	83	90	90	90	90	85
4	Tonsilitis	70	72	73	73	72	65	67	68	......	......
5	Bronchitis	75	70	74	79	80	74	77	75	75	71
6	Consumption, Pulmonary ‡	73	68	72	71	74	78	76	78	76	61
7	Diarrhea	65	66	71	67	69	67	63	65	57	58
8	Remittent Fever ‡	64	52	60	57	64	66	67	69	71	68
9	Influenza	53	47	53	56	55	48	54	57	57	54
10	Pneumonia	56	44	48	59	61	60	62	60	58	56
11	Erysipelas	42	44	48	47	42	42	45	43	35	35
12	Inflammation of Kidney ‡	38	34	41	......	......	......	......	......	......	......
13	Cholera Morbus	33	33	37	32	31	41	34	34	25	26
14	Inflammation of Bowels ‡	29	32	30	31	28	26	25	......	......	......
15	Dysentery	32	28	38	35	31	34	30	31	30	34
16	Typho-malarial Fever ‡	35	27	32	32	39	43	37	32	35	37
17	Diphtheria	37	27	27	31	43	51	43	45	37	32
18	Scarlatina	31	22	29	32	32	32	26	36	38	33
19	Whooping-cough	28	21	29	23	26	24	42	31	28	28
20	Cholera Infantum	23	21	26	24	22	27	23	23	20	17
21	Typhoid Fever (enteric)	20	16	20	19	24	26	21	18	16	22
22	Inflammation of Brain ‡	13	14	14	12	12	12	13	......	......	......
23	Puerperal Fever	12	13	16	15	18	12	8	8	6	10
24	Cerebro-spinal Meningitis	10	12	12	11	12	16	6	5	6	6
25	Membranous Croup	14	10	14	14	15	19	13	16	14	14
26	Measles	21	9	17	37	20	37	30	18	7	12
27	Small-pox	2.1	0.4	0.2	1	5	4	1	1	1	5
	Number of observers	......	163	142	140	159	116	112	110	97	115
	Average No. of Observers per Month	80	104	79	88	93	70	79	73	64	66

* For 1885, the number of observers, reports, weeks in each month, etc., are stated in the first five columns of Exhibit III., page 90; the names of the observers and the number of the reports received from each are stated in Exhibit V, pages 97-99.

† The numbers opposite the names of the diseases do not state what per cent of the whole number of observers for the year reported the disease present at some time during the year, but state (on an average for the twelve months of the year) by what per cent of the observers making reports for the several months, the disease was reported present in those months. The column for each year is thus a statement for an average month of that year. On the two following pages of this table, however, the columns for each month state what per cent of the observers for that month (the number of whom is stated at the foot of the column) reported the given disease in that month.

‡ Consumption, remittent fever, and typho-malarial fever were not printed on the first blanks used in making weekly reports (beginning with the month of September, 1876); neuralgia and tonsilitis were not printed on any blanks used prior to October, 1878, and not on all used for several months after that date; inflammation of brain and inflammation of bowels were not printed on any blanks used prior to July, 1879, and not on all used for several months after that date; inflammation of kidney was not printed on any blanks used prior to October, 1883, and not on all used for several months after that date; hence it is probable that these diseases were not so fully reported at first as were the other diseases.

EXHIBIT V.—*By Months and by Geographical Divisions of the State, the Names of 164 Observers whose Weekly Reports of Diseases for 1885 are Compiled in Tables 1, 2, 3, and 4, the Localities*[a] *for which they Report, and the Number of Reports received from each Observer.*

Divisions and Localities Represented and Physicians who Reported. (Health officers in italics; regular correspondents marked with a *.)	Weekly Reports in 1885.—Compiled for this article.												
	Year, 1885.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
All Localities	*5108*	*280*	*274*	*271*	*314*	*347*	*399*	*564*	*485*	*601*	*495*	*498*	*580*
Upper Peninsular Division †	*179*	*12*	*12*	*8*	*17*	*16*	*14*	*18*	*16*	*20*	*15*	*16*	*15*
Houghton, *H. W. Jones, M. D.**	47	4	4		4	4	4	5	4	5	4	4	5
Ishpeming, *W. E. Harwood, M. D.*	47	4	4	4	5	4	4	5	4	5	4	4	
Mackinac, *Samuel S. Jessop, M. D.*	49	4	4	4	5	4	2	5	4	5	3	4	5
Sault St. Marie, *A. E. Bacon, M. D.*	36				3	4	4	3	4	5	4	4	5
Northwestern Division †	*129*	*15*	*15*	*12*	*15*	*8*	*8*	*14*	*8*	*8*	*8*	*8*	*10*
Cadillac, *C. L. Keach, M. D.*	15	4	4	4	3								
Lake Township, B. F. Huntley, M. D.	52	4	4	4	5	4	4	5	4	5	4	4	5
Manistee, *L. S. Ellis, M. D.*	20							4		3	4	4	5
Manistee, *D. E. Robison, M. D.*	16	4	4	4	4								
Manton, *J. B. Martin, M. D.*	26	3	3		3	4	4	5	4				
Northern Division †	*151*	*11*	*8*	*10*	*15*	*12*	*15*	*18*	*11*	*10*	*14*	*12*	*15*
Charlevoix, *W. M. Preston, M. D.*	42	4	4	4	5	4	4	5			3	4	5
Evangeline T'p, A. W. Nicholson, M. D.*	45	3		2	5	4	4	5	4	5	4	4	5
Harbor Springs, *L. W. Gardner, M. D.*	52	4	4	4	5	4	4	5	4	5	4	4	5
Petoskey, *H. T. Caulkins, M. D.**	12						3	3	3		3		
Northeastern Division †	*179*	*8*	*8*	*13*	*19*	*16*	*15*	*20*	*15*	*15*	*16*	*15*	*19*
Alpena, *J. E. Dunlop, M. D.*	27	4		3	5	4	3	5	3				
East Tawas, *J. S. Reeves, M. D.**	52	4	4	4	5	4	4	5	4	5	4	4	5
Harrisville, D. W. Mitchell, M. D.*	48		4	4	5	4	4	5	4	5	4	4	5
Tawas City, *J. H. Vaughan, M. D.*	11										4	3	4
West Branch, *C. F. Cochran, M. D.**	41			2	4	4	4	5	4	5	4	4	5
Western Division †	*419*	*24*	*21*	*19*	*11*	*24*	*35*	*45*	*38*	*55*	*46*	*47*	*54*
Grand Haven, *J. N. Reynolds, M. D.*	23					4	3			4	4	4	4
Grand Haven, *A. Vanderveen, M. D.**	16	4	4	4	4								
Grand Rapids, Arthur Hazlewood, M. D.*	13										4	4	5
Grandville, *J. W. Cooper, M. D.*	15									3	3	4	5
Hart, A. A. Dunton, Jr., M. D.*	22								4	5	4	4	5
Lowell, *A. M. Ellsworth, M. D.*	33					4	4	5	4	3	4	4	5
Lowell, *A. B. Grant, M. D.*	12	4	4	4									
Montague, *J. W. Switzer, M. D.*	35					4	4	5	4	5	4	4	5
Muskegon, *G. Chaddock, M. D.*	15	4	3	4	4								
Muskegon, *C. L. Thompson, M. D.*	23						4	5	3	5	3	3	
Muskegon, John P. Stoddard, M. D.*	31						4	5	4	5	4	4	5
Newaygo, *D. W. Flora, M. D.*	17						4	5	3	5			
North Muskegon, *N. W. Andrews, M. D.*	12	4	4	4									
North Muskegon, *George C. Havens, M. D.*	31						4	5	4	5	4	4	5
Pentwater, *G. O. Switzer, M. D.*	45	4	3		3	4	4	5	4	5	4	4	5
Sand Lake, *F. C. Chappell, M. D.*	31					4		5	4	5	4	4	5
Spring Lake, *Edward Hofma, M. D.*	35					4	4	5	4	5	4	4	5
Whitehall, *J. H. Johnson, M. D.*	10	4	3	3									
Northern Central Division †	*79*	*8*	*7*	*4*	*5*	*4*	*4*	*8*	*8*	*8*	*7*	*6*	*10*
Big Rapids, *I. W. Badger, M. D.*	52	4	4	4	5	4	4	5	4	5	4	4	5
Franklin Township, A. J. Scott, M. D.*	7	4	3										
Harrison, *P. E. Witherspoon, M. D.*	20							3	4	3	3	2	5
Bay and Eastern Division †	*639*	*28*	*27*	*30*	*37*	*37*	*42*	*78*	*66*	*84*	*69*	*71*	*70*
Algonac, *W. K. Moore, M. D.*	48	4	4	4	4	4	4	4	3	5	4	4	4
Almont, *Adam Price, M. D.*	25						2	3	3	4	4	4	5
Bay City, *James W. Caughlin, M. D.*	22						2	5	4	4	4	3	
Brown City, J. A. Watson, M. D.	39			4	4	4	4	4	4	3	4	4	4
Capac, *James R. McGurk, M. D.*	26							5	4	5	4	4	4
Columbiaville, *C. A. Wisner, M. D.**	52	4	4	4	5	4	4	5	4	5	4	4	5
East Saginaw, *J. S. Rouse, M. D.*	16	4	4	4	4								
Emmett, *A. J. Abbott, M. D.*	23					3	2	3	4	4	3	4	
Essexville, *A. J. Harris, M. D.*	20								4	4	3	4	5
Lapeer, *A. E. Burdick, M. D.*	23						3	5	4	5	4	2	
Marine City, *Delos L. Parker, M. D.*	20							3		4	4	4	5

[a] In many cases the reports include sickness in the vicinity as well as the corporate limits of the places named.
* Regular Correspondent. † For counties in each division see Exhibit I, page 87.

EXHIBIT V.—Continued.

Divisions and Localities Represented and Physicians who Reported. (Health officers in italics; regular correspondents marked with a *.)	Weekly Reports in 1885.—Compiled for this article.												
	Year, 1885.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Bay and Eastern Division—*Continued*.†													
Metamora, *George W. Stone, M. D.*	26	----	----	----	----	----	----	5	4	4	4	4	5
Port Huron, *M. Northup, M. D.**	52	4	4	4	5	4	4	5	4	5	4	4	5
St. Charles, *Charles M. Bradt, M. D.*	30	----	----	----	----	4	----	4	4	5	4	4	5
Saint Clair, *A. L. Padfield, M. D.**	13	----	----	----	----	----	2	4	2	5	----	----	----
Sand Beach, *H. R. Hitchcock, M. D.*	51	4	4	4	5	4	4	5	4	5	4	3	5
Sandusky, *Lotan C. Read, M. D.*	26	----	----	----	----	----	----	4	4	5	4	4	5
Sebewaing, *Josiah Black, M. D.*	30	----	----	----	----	4	4	4	4	3	3	4	4
South Bay City, S. E. Campbell, M. D.*	39	4	3	2	5	2	3	5	2	5	4	4	----
Thornville, John S. Caulkins, M. D.*	51	4	4	4	5	4	4	5	4	4	4	4	5
Vassar, *T. Allen Cullis, M. D.*	7	----	----	----	----	----	----	----	----	----	----	3	4
Central Division†	*1046*	*62*	*63*	*64*	*65*	*70*	*76*	*107*	*89*	*121*	*96*	*106*	*127*
Assyria, Chas. E. Fay, M. D.	16	----	----	----	----	----	----	----	----	5	3	4	4
Dansville, C. L. Randall, M. D.	27	----	3	4	4	2	----	5	4	5	----	----	----
Edmore, *L. A. Roller, M. D.**	25	----	----	----	----	----	----	5	2	5	4	4	5
Flint, *O. Millard, M. D.*	28	----	----	----	----	4	3	----	4	5	4	4	4
Flint, *A. A. Thompson, M. D.*	12	4	4	4	----	----	----	----	----	----	----	----	----
Greenville, *John Avery, M. D.*	29	----	----	----	----	----	3	5	4	5	3	4	5
Greenville, C. M. Martin, M. D.*	25	----	----	----	----	----	4	5	4	3	3	2	4
Hastings, A. P. Drake, M. D.*	52	4	4	4	5	4	4	5	4	5	4	4	5
Hastings, *D. E. Fuller, M. D.*	33	----	----	----	----	4	4	5	3	4	4	4	5
Hastings, *W. P. Polhemus, M. D.*	16	4	4	4	4	----	----	----	----	----	----	----	----
Howard City, *J. N. Hathaway, M. D.*	8	4	4	----	----	----	----	----	----	----	----	----	----
Howard City, *Truman Sawdy, M. D.*	26	----	----	----	----	----	----	4	4	5	4	4	5
Hubbardston, *C. S. Park, M. D.*	51	4	4	4	5	3	4	5	4	5	4	4	5
Ithaca, C. L. Barber, M. D.*	9	----	----	----	----	----	----	----	----	----	----	4	5
Ithaca, *J. P. Carpenter, M. D.*	52	4	4	4	5	4	4	5	4	5	4	4	5
Lakeview, *A. H. Forsyth, M. D.*	52	4	4	4	5	4	4	5	4	5	4	4	5
Lansing, J. H. Wellings, M. D.*	33	----	----	4	5	4	4	4	----	----	3	4	5
McBrides, *R. P. Comfort, M. D.*	30	----	----	----	----	4	2	3	4	5	4	4	4
Mason, *S. H. Culver, M. D.**	30	2	----	----	----	2	4	5	2	4	4	4	3
Middleville, *G. W. Matteson, M. D.*	52	4	4	4	5	4	4	5	4	5	4	4	5
Mt. Morris, *F. A. Cady, M. D.*	10	----	----	----	----	----	----	----	----	----	2	4	4
Muir, *B. E. Terrill, M. D.*	12	4	4	4	----	----	----	----	----	----	----	----	----
Owosso, *S. S. C. Phippen, M. D.*	23	----	----	----	----	----	----	4	4	5	2	4	4
Pierson, *James Totten, M. D.*	35	----	----	----	----	4	4	5	4	5	4	4	5
Portland, *George D. Allen, M. D.*	52	4	4	4	5	4	4	5	4	5	4	4	5
Saint Johns, *L. W. Fasquelle, M. D.*	50	4	4	4	3	4	4	5	4	5	4	4	5
Sheridan, *W. H. Budd, M. D.*	51	4	4	4	5	4	4	4	4	5	4	4	5
Swartz Creek, *G. G. Gordon, M. D.**	52	4	4	4	5	4	4	5	4	5	4	4	5
Vermontville, *P. L. Green, M. D.*	20	----	----	----	----	----	----	----	2	5	4	4	5
Vernon, *W. H. Holtzman, M. D.*	33	----	----	----	----	3	4	4	4	5	4	4	5
Vernon T'p, Ambrose G. Cowles, M. D.*	51	4	4	4	5	4	4	4	4	5	4	4	5
Woods Corners, George Pray, M. D.*	51	4	4	4	4	4	4	5	4	5	4	4	5
Southwestern Division†	*428*	*16*	*16*	*16*	*19*	*27*	*34*	*45*	*49*	*54*	*49*	*48*	*55*
Benton Harbor, *Isaac R. Dunning, M. D.*	34	----	----	----	----	4	4	5	4	5	4	4	4
Bloomingdale, *W. B. Hathaway, M. D.*	32	----	----	----	----	2	4	5	4	5	3	4	5
Breedsville, *N. J. Cranmer, M. D.*	33	----	----	----	----	3	4	5	4	5	4	4	4
Decatur, *G. L. Rose, M. D.*	22	----	----	----	----	----	----	----	4	5	4	4	5
Galien, *Cyrus J. Bulhand, M. D.*	20	----	----	----	----	----	4	4	4	5	3	----	----
Hartford, *H. C. Maynard, M. D.*	29	----	----	----	----	2	2	3	4	5	4	4	5
Lawrence, *Sylvanus Rowe, M. D.*	13	----	----	----	----	----	----	----	2	----	3	4	4
Niles, *O. P. Horn, M. D.*	51	4	4	4	4	4	4	5	4	5	4	4	5
Otsego, *Milton Chase, M. D.**	52	4	4	4	5	4	4	5	4	5	4	4	5
Saugatuck, *H. H. Stimson, M. D.*	52	4	4	4	5	4	4	5	4	5	4	4	5
South Haven, *M. E. Bishop, M. D.*	52	4	4	4	5	4	4	5	4	5	4	4	5
Three Oaks, *Fred F. Sovereign, M. D.*	19	----	----	----	----	----	----	----	4	4	4	4	3
Wayland, *H. J. Turner, M. D.*	19	----	----	----	----	----	----	3	3	----	4	4	5
Southern Central Division†	*1095*	*61*	*63*	*60*	*68*	*76*	*89*	*122*	*109*	*136*	*100*	*93*	*118*
Adrian, *J. Tripp, M.D.*	45	3	4	4	4	2	3	4	4	5	4	4	4
Albion, *R. A. Martin, M. D.*	12	4	4	4	----	----	----	----	----	----	----	----	----
Albion, *H. D. Thomason, M. D.*	9	----	----	----	----	----	----	----	----	4	3	2	----
Augusta, *L. A. Harris, M. D.*	13	----	----	----	----	----	4	----	4	5	----	----	----
Burr Oak, *John C. Rollmann, M. D.*	34	----	----	----	----	4	3	5	4	5	4	4	5
Coldwater, *J. M. Long, M. D.*	11	4	4	3	----	----	----	----	----	----	----	----	----
Coldwater, *L. A. Warsabo, M. D.*	34	----	----	----	----	4	3	5	4	5	4	4	5
Coldwater, L. H. Wurtz, M. D.*	51	4	4	4	5	3	4	5	4	5	4	4	5
Constantine, *S. C. Culp, M. D.*	30	----	----	----	----	----	3	5	4	5	4	4	5

* Regular Correspondent.

† For counties in each division see Exhibit I, page 87.

[This Exhibit V. is continued on page 99.]

EXHIBIT V.—CONTINUED.

Divisions and Localities Represented and Physicians who Reported. (Health officers in italics; regular correspondents marked with a *.)	Weekly Reports in 1885.—Compiled for this article.												
	Year, 1885.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Southern Central Division—*Continued.*†													
Hanover, *James A. Wilson, M. D.*	18	----	----	----	----	----	2	4	4	5	3	----	----
Hudson, A. R. Smart, M. D.*	50	4	4	4	5	4	4	5	4	5	3	3	5
Jackson (Prison), *F. R. Crosby, M. D.*	12	4	4	4	----	----	----	----	----	----	----	----	----
Jackson (Prison), *Wm. H. Palmer, M. D.*	39	----	----	----	5	4	4	4	4	5	4	4	5
Jerome, A. A. Dunton, Jr., M. D.*	21	4	4	4	5	4	----	----	----	----	----	----	----
Jonesville, *H. M. Warren, M. D.*	26	----	----	----	----	----	----	5	4	4	4	4	5
Kalamazoo, H. B. Hemenway, M .D.*	49	3	4	4	5	4	4	5	4	5	2	4	5
Kalamazoo, *Wm. Mottram, M. D.*	25	----	----	----	3	4	3	5	4	3	----	3	----
Kalamazoo, H. H. Schaberg, M. D.	48	4	4	4	4	2	4	5	4	4	4	4	5
Kalamazoo, W. B. Southard, M. D.*	52	4	4	4	5	4	4	5	4	5	4	4	5
Litchfield, *E. P. Buckley, M. D.*	18	----	----	----	----	----	----	----	2	4	4	3	5
Marshall, *E. J. Marshall, M. D.*	48	4	3	2	4	4	4	5	4	5	4	4	5
Mendon, *H. C. Clapp, M. D.**	52	4	4	4	5	4	4	5	4	5	4	4	5
Morenci, *N. H. Bailey, M. D.*	29	----	----	----	----	4	4	5	4	4	4	----	4
Parma, *O. S. Hartson, M. D.*	31	----	----	----	----	3	4	4	4	5	4	2	5
Reading, *E. H. Damon, M. D.*	33	----	----	----	----	4	2	5	4	5	4	4	5
Reading, B. G. Strong, M. D.*	25	----	----	----	----	----	----	3	4	5	4	4	5
Richland, *J. M. Rankin, M. D.*	33	----	----	----	----	3	4	5	3	5	4	4	5
Springport, *A. W. Troupe, M. D.**	28	----	----	----	----	----	2	4	4	5	4	4	5
Tecumseh, *C. M. Woodward, M. D.**	34	----	----	----	----	4	4	4	4	5	4	4	5
Union City, *R. P. Beebe, M. D.**	49	4	4	4	5	4	4	5	4	3	3	4	5
Union City, *H. F. Ewers, M. D.**	20	----	----	----	----	----	4	5	4	5	2	----	----
Union City, E. H. Hurd, M. D.*	15	4	4		3	----	----	----	----	----	----	----	----
Vicksburg, *C. H. McKain, M. D.*	52	4	4	4	5	4	4	5	4	5	4	4	5
Ypsilanti, *C. F. Ashley, M. D.*	15	3	4	3	5	----	----	----	----	----	----	----	----
Ypsilanti, *Edward Batwell, M. D.**	34	----	----	----	----	3	4	5	4	5	4	4	5
Southeastern Division†	*764*	*35*	*34*	*35*	*43*	*57*	*67*	*89*	*76*	*90*	*75*	*76*	*87*
Armada, *Wm. Flagler, M. D.*	12	4	4	4	----	----	----	----	----	----	----	----	----
Armada, *C. H. Lincoln, M. D.**	38	----	----	----	5	3	4	5	4	4	4	4	5
Birmingham, *J. L. Campbell, M. D.*	24	----	----	----	----	----	----	3	4	5	3	4	5
Detroit, David Inglis, M. D.*	11	----	----	----	----	----	----	----	----	4	4	3	----
Detroit, W. H. Rouse,M . D.*	50	4	4	4	5	2	4	5	4	5	4	4	5
Dundee, *J. B. Haynes, M. D.*	26	----	----	----	----	----	----	5	4	5	3	4	5
Holly, *L. E. Wickens, M. D.*	52	4	4	4	5	4	4	5	4	5	4	4	5
Memphis, *D. H. Cole, M. D.*	52	4	4	4	5	4	4	5	4	5	4	4	5
Monroe, *Geo. B. McCallum, M. D.*	34	----	----	----	----	4	4	4	4	5	4	4	5
New Baltimore, *David Hammell, M. D.*	28	----	----	----	----	4	4	5	4	----	2	4	5
New Haven, *Edgar B. Harris, M. D.*	31	----	----	----	----	4	3	5	4	3	3	4	5
Northville, *J. M. Burgess, M. D.*	33	----	----	----	----	3	4	5	4	5	4	4	4
Northville, J. M. Swift, M. D.*	51	4	4	4	5	4	4	5	4	5	4	3	5
Oxford, *E. P. B. Wilder, M. D.*	35	----	----	----	----	4	4	5	4	5	4	4	5
Petersburg, *T. H. McDonald, M. D.*	24	----	----	----	----	3	4	4	4	4	3	2	----
Pontiac, *W. G. Elliott, M. D.**	35	----	----	----	----	4	4	5	4	5	4	4	5
Pontiac, *W. McCarroll, M. D.*	16	4	4	4	4	----	----	----	----	----	----	----	----
Richmond, *C. L. Chandler, M. D.*	16	4	3	4	5	----	----	----	----	----	----	----	----
Richmond, *S. S. Stearns, M. D.*	22	----	----	----	----	----	4	5	4	5	4	----	----
Romeo, *Wm Greenshields, M. D.*	47	3	3	3	4	4	4	5	4	5	3	4	5
Romeo, *J. P. Letts, M. D.*	30	----	----	----	----	2	4	3	4	5	4	4	4
South Lyon, *F. E. Holmes, M. D.*	11	----	----	----	----	----	----	----	----	----	2	4	5
Wayne, *J. M. Truscott, M. D.*	34	----	----	----	----	4	4	5	4	5	4	4	4
Wyandotte, *E. P. Christian M. D.**	52	4	4	4	5	4	4	5	4	5	4	4	5

* Regular Correspondent. † For counties in each division see Exhibit I, page 87.

TABLE 2.—WEEKLY REPORTS OF DISEASES IN MICHIGAN IN 1885.—*Exhibiting for the Year and for each Month of the Year Ending Saturday, January 2, 1886, a Summary relative to Diseases in the State of Michigan; also for each Month a Summary relative to Diseases in each of 11 Geographical Divisions* of the State,—Indicating the Prevalence as regards Time and Area. Compiled from 5,108 Weekly Reports by 164 Observers, Health Officers of Cities and Villages, Regular Correspondents of the State Board of Health, and other Physicians, Reporting the Diseases under their observation.*

Number of Observers, Reports, Etc.	Diseases.	(Av.[b]) Per Cent of Observers Reporting Presence of.	Average Per Cent of Weeks Reported Present where Present.[c]	Per Cent of Reports Stating Presence of.[d]	Average Order of Prevalence where Present.[e]	Average Order of Prevalence where Present.								
						1884.	1883.	1882.	1881.	1880.	1879.	1878.	1877.	Av. 1877-1885.
Year Ending January 2, 1886.† Average number of Localities represented, 135. Whole number of Observers during the year, 164. Average per month, 104. Total number of reports compiled, 5,108. per Month, 426.	Average for tabulated diseases reported present.	38	68	26	3.8	4.2	4.2	4.2	4.9	4.7	4.7	4.4	4.1	.....
	Brain, Inflammation of	14	42	6	6.0	6.4	6.6	6.6	8.7	8.1	.....	.....	.....	.....
	Bowels, Inflammation of	32	53	17	5.1	5.8	6.1	6.0	7.4	7.0	.....	.....	.....	.....
	Bronchitis	70	79	56	3.1	3.2	3.2	3.3	3.9	3.7	3.6	3.3	2.3	3.3
	Cerebro-Spinal Meningitis	12	51	6	6.9	6.9	7.4	7.2	7.9	7.1	7.4	5.9	6.0	7.0
	Cholera Infantum	21	49	11	4.6	4.8	4.8	4.9	5.1	5.2	5.4	5.7	4.9	5.1
	Cholera Morbus	33	52	17	4.5	4.9	5.0	5.2	5.3	5.3	5.3	5.7	4.7	5.2
	Consumption, Pulmonary	68	85	58	4.0	4.3	4.5	4.6	5.6	5.7	5.6	5.2	5.1	5.1
	Croup, Membranous	10	48	5	6.1	7.1	7.1	7.0	8.2	7.4	6.6	7.1	6.1	7.1
	Diphtheria	27	53	14	4.7	5.1	5.4	4.8	5.6	5.7	5.4	5.4	5.3	5.3
	Diarrhea	66	68	46	3.3	3.3	3.7	3.8	3.9	4.2	4.4	4.2	3.8	3.9
	Dysentery	28	52	15	5.0	5.0	5.2	5.3	5.1	5.8	6.2	5.9	4.9	5.4
	Erysipelas	44	55	24	4.6	5.2	5.5	5.5	6.2	6.3	6.5	6.4	5.8	5.9
	Fever, Intermittent	73	80	59	2.4	2.5	2.3	2.0	2.4	2.3	2.2	2.1	2.2	2.3
	Fever, Remittent	52	69	36	3.2	3.3	3.3	3.3	3.5	3.3	3.3	3.1	3.1	3.3
	Fever, Typhoid (Enteric)	16	52	8	4.7	5.2	5.1	5.1	6.2	6.5	7.0	7.0	5.5	6.0
	Fever, Typho-Malarial	27	59	16	4.4	4.6	4.8	4.9	5.2	5.5	5.8	5.4	4.7	5.1

For the Whole number of Localities sented per month, 96. age number of observers Average No. of Reports

Influenza	47	72	34	2.9	3.3	3.2	3.1	3.5	3.0	3.1	3.1	3.0	3.2
Kidney, Inflammation of	34	65	21	4.4	5.0	......	......	......	......	......	......	......	......
Measles	9	53	.5	6.4	5.2	3.7	4.9	4.4	4.8	4.7	5.3	5.0	4.8
Neuralgia	83	82	68	2.8	3.3	3.3	3.6	4.3	4.5	4.5	......	......	......
Pneumonia	44	60	27	4.4	4.5	4.7	4.4	5.4	5.1	5.2	4.8	4.0	4.8
Pnerperal Fever	13	46	6	6.3	6.9	7.3	6.2	8.2	7.8	7.2	6.3	6.1	7.0
Rheumatism	83	83	68	3.2	3.6	3.7	3.8	4.6	4.6	4.6	4.2	4.0	4.1
Scarlatina	22	54	12	5.0	5.2	5.2	4.9	6.7	6.5	5.5	5.4	4.8	5.5
Small-pox	0.4	57	0.2	8.4	26.0	14.0	9.1	8.9	6.3	10.6	3.9	6.8	10.7
Tonsilitis	72	69	50	3.5	3.7	3.9	3.9	4.5	4.4	4.5		......	......
Whooping-cough	21	66	14	4.1	4.5	5.2	4.4	6.3	5.5	4.7	4.8	5.1	5.1

* For Counties in each Division, see Exhibit I., page 87.

† For number of Observers, reports, weeks in each month, etc., see Exhibit III., pages 90; for names of observers, and number of reports received from each, see Exhibit V., pages 97–99.

[a] Not every one of the observers sent in a report for every week, so that the number of reports received does not equal the number of observers multiplied by the number of weeks.

[b] The numbers in this column (pages 100-101) state not what per cent of the whole number of observers for the year reported the disease present at some time during the year, but the average (for the twelve months) of the per cents (of observers making reports for the several months) by which the disease was reported present in those months. The column for the year is thus a statement for an average *month*. But on pages 102 and 103 the numbers in the "Per Cent of Observers" column are statements for the month, and not averages. This column indicates the Area of Prevalence, except that in a few instances there were two or more observers in one city or village.

[c] This column states for the year or given month, what per cent the number of reports which stated a disease to be present is of the number of card-reports received, for the given time, from such of the observers as reported the disease present. It is therefore an average not for all localities represented, but only for those at which the given disease was reported present. In the line "Average for Tabulated Diseases" it states what per cent the number of times *all* diseases were reported present is of the number of times they *might have been* so reported on the cards received, for the time specified, from the observers who during that time reported the diseases present (that is, if each of the observers had on every card he sent reported every disease present which he reported present at all). It will be seen that this is a more accurate average than would be obtained by dividing the sum of the column by the number of diseases reported present.

[d] This column states what per cent the number of reports stating presence of a disease is of the whole number of reports reseived for the time specified, from *all observers* in the State or Division, as the case may be. It combines, and states in a general way, an idea of the *time* a disease was prevalent, with an idea of the area of its prevalence. Had every observer sent a report every week of the month or year, the numbers in this column would be (for the State) the product of the numbers in the same line in the two preceding columns.

[e] The disease having the greatest number of cases was to be marked 1 in the order; the disease having the next greatest number of cases, 2: and so on. Diseases not present were to be marked 0. The numbers in this column are found by dividing the totals (for the State) of the Order of Prevalence column, in Table 3 (a table giving statements for each locality, omitted in printing this Report, for want of room). by the number of men who reported the disease present. The column is, therefore, an average not for all the localities represented, but only for those at which the given disease was reported present. The numbers in the "Average" lines for this column are found by dividing the sum of the totals in the Order of Prevalence columns, in Table 3, for all diseases reported present, by the sum of the numbers of men who reported the different diseases present, thus counting each man once for every disease he reported present. As a rule, small numbers in this column indicate a large prevalence of the disease, and *vice versa;* but the greater the number of diseases reported present by each observer from week to week, the greater will be the "average" in this column.

TABLE 2.—CONTINUED.—*Diseases in the State, 1885.* (*For foot-notes and full tabular heads, see pages 100–101.*)

Diseases.	January.† Per ct. of Observers Reporting Pres. of. b	January.† Av. per ct. of Weeks Reported Present where Present. a, c	January.† Per cent. of Reports Stating Pres. of. d	January.† Av. Order of Prevalence where Pres. e	February.† Per ct. of Observers Reporting Pres. of. b	February.† Av. per ct. of Weeks Reported Present where Present. a, c	February.† Per. cent of Reports Stating Pres. of. d	February.† Av. Order of Prevalence where Pres. e	March.† Per ct. of Observers Reporting Pres. of. b	March.† Av. per ct. of Weeks Reported Present where Present. a, c	March.† Per cent of Reports Stating Pres. of. d	March.† Av. Order of Prevalence where Pres. e	April.† Per ct. of Observers Reporting Pres. of. b	April.† Av. per ct. of Weeks Reported Present, where Present. a, c	April.† Per cent. of Reports stating presence of. d	April.† Av. order of prevalence, where Pres. e	May.† Per ct. of Observers Reporting Pres. of. b	May.† Av. per ct. of Weeks Reported Present, where present. a, c	May.† Per cent. of Reports stating Pres. of. d	May.† Av. order of prevalence, where Pres. e	June.† Per ct. of Observers Reporting Pres. of. b	June.† Av. per ct. of Weeks Reported Present, where present. a, c	June.† Per cent. of Reports stating Pres. of. d	June.† Av. order of Prevalence, where Pres. e
Av. for Tab. Dis. Rep. Pres.	38	76	29	4.3	38	75	29	4.3	40	76	30	4.4	39	71	28	4.1	36	68	25	3.8	35	68	24	3.8
Brain, Inflammation of	15	48	8	6.3	13	57	7	7.4		51	9	5.8	26	40	11	5.8	14	37	5	5.8	15	44	7	5.3
Bowels, Inflammation of	21	66	14	6.9	31	51	16	6.1	31	63	20	6.5	33	51	17	6.3	34	53	18	4.5	33	53	18	4.9
Bronchitis	82	89	73	2.5	85	87	74	2.4	85	90	76	2.5	80	89	73	2.7	72	79	56	3.0	69	75	52	3.5
Cerebro-spinal Meningitis	10	82	8	7.4	14	54	9	7.7	18	65	12	7.6	16	52	8	6.7	12	50	6	6.6	11	45	5	8.4
Cholera Infantum	10	29	3	6.6	3	43	1	6.5	3	50	1	7.5	3	56	2	6.0	12	40	5	7.5	15	48	7	6.3
Cholera Morbus	10	32	3	7.4	8	43	4	6.5	18	42	8	8.0	17	40	7	5.9	22	41	10	5.6	37	45	18	4.4
Consumption, Pulmonary	64	94	60	4.7	72	93	68	4.9	80	88	71	4.6	80	88	69	4.2	71	82	58	3.9	70	87	61	3.6
Croup, Membranous	29	57	16	5.5	18	53	10	6.0	18	50	10	5.4	13	49	6	6.4	7	35	3	7.0	6	43	3	6.3
Diphtheria	22	62	14	5.4	20	56	10	4.9	20	56	11	6.6	20	77	16	5.9	16	53	9	4.7	24	48	12	4.5
Diarrhea	40	65	26	5.2	49	63	31	5.1	52	68	35	4.9	51	66	33	4.8	56	62	36	3.7	62	69	44	3.6
Dysentery	15	48	8	7.7	13	51	7	8.1	17	44	7	7.4	20	43	9	6.2	14	53	7	7.0	18	57	11	6.5
Erysipelas	49	65	32	5.5	55	63	35	5.0	54	65	35	5.2	49	61	29	5.1	46	59	27	4.2	41	57	24	4.5
Fever, Intermittent	60	86	51	3.4	65	80	52	3.5	63	79	51	3.5	72	78	57	2.7	77	82	64	2.3	75	89	68	1.9
Fever, Remittent	43	75	33	4.2	45	71	32	4.2	52	81	43	3.7	51	76	38	3.8	46	71	33	3.1	50	70	35	3.1
Fever, Typhoid (Enteric)	18	62	11	6.8	11	59	7	6.3	10	48	5	6.0	10	34	4	5.6	10	40	3	5.4	9	50	5	5.0
Fever, Typho-malarial	24	65	15	4.9	27	61	16	5.7	21	68	14	6.1	16	65	10	5.9	21	53	11	4.3	20	51	10	4.0
Influenza	67	85	58	2.3	69	86	60	2.6	63	82	52	2.3	61	78	41	2.5	46	65	31	3.0	33	67	23	3.2
Kidney, Inflammation of	35	73	26	4.9	39	70	27	4.4	41	59	24	4.7	35	65	22	4.7	36	60	22	4.5	32	62	21	4.0
Measles	7	60	4	11.4	10	70	7	7.1	14	70	10	6.8	20	48	10	5.6	18	49	9	4.8	12	62	7	5.2
Neuralgia	89	89	79	2.8	89	89	79	3.1	87	88	77	3.0	88	84	75	2.7	83	82	67	2.8	81	82	67	2.6
Pneumonia	69	70	50	4.4	73	79	58	3.4	75	79	60	4.0	72	70	50	4.1	52	59	31	4.2	35	53	19	5.1
Puerperal Fever	8	46	4	8.0	7	75	5	10.4	17	57	10	6.8	17	44	8	7.0	13	48	6	6.2	12	42	5	5.7
Rheumatism	85	86	73	3.4	86	87	76	3.5	87	93	82	3.6	90	87	79	3.8	87	87	74	2.8	84	84	71	3.0

Scarlatina	28	60	16	[illegible]	30	58	18	6.2	24	56	14	7.4	26	49	13	5.9	23	54	13	4.8	22	66	[illegible]	[illegible]
Small-pox	0	0	0	0	1	50	1	9.0	1	25	0.4	9.0	1	20	0.3	10.0	1	100	1	5.0	1	100	1	9.0
Tonsilitis	78	81	63	3.2	82	71	58	3.5	77	79	61	3.5	70	76	53	3.6	74	67	50	3.4	65	65	43	3.6
Whooping-cough	24	73	18	4.5	20	79	16	4.9	28	69	20	4.8	25	68	17	4.5	14	67	9	4.2	15	61	10	4.9

	July.†				August.†				September.†				October.†				November.†				December.†			
Av. for Tab. Dis. Rep. Pres.	40	64	26	3.7	40	68	27	3.8	43	62	27	3.7	38	67	26	3.6	38	69	26	3.7	30	66	26	3.6
Brain, Inflammation of	16	36	6	5.4	13	42	6	6.5	12	41	5	6.6	10	49	5	6.1	11	45	5	5.8	16	35	6	5.9
Bowels, Inflammation of	34	47	16	5.4	39	52	20	4.4	27	49	13	4.8	32	51	17	4.7	28	60	16	5.3	34	50	17	4.5
Bronchitis	57	76	44	3.8	51	75	39	4.2	66	68	45	3.3	68	75	51	3.1	72	80	58	2.9	80	80	64	2.6
Cerebro-spinal Meningitis	17	43	8	6.4	12	48	6	7.1	15	42	6	5.7	8	71	5	6.8	5	36	2	6.6	8	47	4	7.2
Cholera Infantum	39	55	22	4.1	58	60	35	3.8	45	42	18	4.1	17	44	8	5.0	8	43	4	7.0	6	38	2	4.3
Cholera Morbus	70	56	40	3.4	69	70	47	3.3	55	47	26	4.2	24	44	11	5.6	15	45	7	5.5	12	41	5	6.9
Consumption, Pulmonary	65	85	56	3.8	61	83	52	4.1	66	81	54	3.8	63	86	55	3.8	65	87	56	4.0	67	82	56	3.7
Croup, Membranous	4	36	2	7.6	2	58	1	10.7	8	37	3	6.7	8	42	3	5.9	11	43	5	5.9	10	54	5	5.3
Diphtheria	28	48	14	4.8	25	53	13	5.2	31	48	15	4.5	34	53	19	4.3	32	49	16	4.4	33	53	17	4.1
Diarrhea	89	74	65	2.3	96	81	77	2.2	88	75	65	2.4	67	65	44	3.0	53	61	33	4.0	55	50	27	3.9
Dysentery	30	51	16	5.0	59	57	34	4.0	57	50	29	3.8	28	55	16	4.1	20	59	12	5.9	15	47	7	6.3
Erysipelas	44	46	21	4.4	31	52	16	4.8	39	44	17	4.4	36	50	18	4.4	45	57	26	4.6	54	52	28	4.1
Fever, Intermittent	80	83	67	2.0	80	82	65	2.3	85	77	65	2.1	74	80	60	2.1	69	80	55	2.4	68	73	49	2.7
Fever, Remittent	50	63	32	3.1	57	68	39	2.9	63	65	40	3.0	53	74	39	2.7	55	70	38	3.1	50	62	31	3.2
Fever, Typhoid (enteric)	13	40	5	4.9	13	48	6	4.3	21	52	11	4.1	23	56	13	4.0	28	59	16	4.2	14	58	8	4.8
Fever, Typho-malarial	20	47	10	4.0	26	55	15	4.5	41	59	24	4.1	36	67	25	3.8	34	63	21	3.9	23	59	14	4.4
Influenza	27	67	18	3.7	32	57	18	4.1	49	61	30	3.4	43	72	31	2.7	51	74	37	2.6	55	72	40	2.5
Kidney, Inflammation of	33	55	18	4.3	31	63	19	4.7	28	58	17	4.8	38	57	21	4.1	32	61	19	4.3	34	60	20	4.3
Measles	15	49	8	5.9	3	63	2	9.3	3	55	2	9.5	2	50	1	10.0	6	48	3	7.0	8	33	3	5.4
Neuralgia	80	76	61	2.8	72	80	58	3.2	78	81	64	2.9	78	79	62	2.8	82	82	67	2.5	87	84	73	2.4
Pneumonia	25	43	11	5.0	21	47	10	5.1	30	38	12	5.1	33	49	17	4.5	39	57	22	4.9	52	59	31	4.0
Puerperal Fever	15	34	5	5.7	13	43	5	6.2	12	39	4	6.0	10	53	5	6.7	12	57	7	5.9	17	46	7	5.2
Rheumatism	82	76	63	3.3	76	79	59	3.7	78	75	60	3.4	77	83	64	3.0	83	84	70	2.9	86	81	70	2.8
Scarlatina	23	53	13	4.0	15	52	8	4.8	16	43	7	5.1	22	56	13	4.1	21	55	11	4.5	21	52	11	4.2
Small-pox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tonsilitis	61	62	38	3.4	57	66	37	4.0	70	61	42	3.7	71	68	48	3.4	80	73	58	3.3	83	73	60	3.1
Whooping-cough	21	63	14	4.1	23	70	16	3.1	23	67	16	4.0	22	64	15	3.7	21	66	14	3.8	23	55	13	3.8

TABLE 2.—CONTINUED.—*Diseases in the Upper Peninsular, the Northwestern, the Northern, and the Northeastern Divisions of the State for the years 1877-1885, and by Months in 1885,—Indicating what Per Cent of the Weekly Reports Received Stated the Presence of the Diseases Named.*[d]

Div.*	Diseases.	'77-'85.‡	1885.†	Jan.†	Feb.†	March.†	April.†	May.†	June.†	July.†	Aug.†	Sept.†	Oct.†	Nov.†	Dec.†
Upper Peninsular Division.*	Av. for Tab. Dis. Rep. Pres.	30	29	51	44	63	46	32	31	38	37	34	32	32	35
	Brain, Inflammation of	6	16	17	8	0	0	19	14	6	6	20	13	31	33
	Bowels, Inflammation of	21	23	17	42	50	12	25	21	33	31	25	13	19	0
	Bronchitis	72	67	100	100	100	71	56	50	56	56	65	73	44	67
	Cerebro-spinal Meningitis	2	2	0	8	0	0	6	7	0	0	0	0	0	0
	Cholera Infantum	13	8	0	0	0	0	0	0	11	44	25	0	0	0
	Cholera Morbus	17	16	0	0	0	6	0	7	33	56	40	7	13	0
	Consumption, Pulmonary	76	70	100	100	100	76	50	64	67	75	65	73	63	40
	Croup, Membranous	6	6	33	8	25	18	6	0	0	0	0	0	0	0
	Diphtheria	8	18	33	25	50	29	0	7	33	13	10	0	13	20
	Diarrhea	61	58	50	33	88	65	50	57	83	81	65	67	31	20
	Dysentery	26	30	25	33	38	35	19	21	28	69	45	13	25	0
	Erysipelas	25	18	33	25	25	6	6	14	17	13	25	13	19	33
	Fever, Intermittent	9	12	0	8	0	0	19	14	22	19	15	13	6	20
	Fever, Remittent	16	9	17	0	0	0	0	7	0	19	15	27	25	0
	Fever, Typhoid (enteric)	30	17	42	25	13	0	6	21	22	6	15	27	31	0
	Fever, Typho-malarial	4	2	0	8	0	0	0	0	0	0	0	7	0	7
	Influenza	50	43	92	58	50	53	38	29	28	25	25	40	50	53
	Kidney, Inflammation of	58	66	92	67	75	76	69	57	50	63	50	73	75	60
	Measles	18	15	0	0	25	0	13	36	56	25	5	7	0	7
	Neuralgia	55	63	75	92	100	82	50	50	67	50	50	53	50	60
	Pneumonia	41	43	83	58	88	47	44	57	33	44	35	20	25	20
	Puerperal Fever	5	4	0	0	0	0	0	0	11	0	0	13	19	0
	Rheumatism	66	58	83	100	100	94	56	43	72	50	40	47	25	20
	Scarlatina	30	13	8	0	0	12	13	29	22	13	0	13	25	20
	Small-pox	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Div.*	Diseases.	'77-'85.‡	1885.†	Jan.†	Feb.†	March.†	April.†	May.†	June.†	July.†	Aug.†	Sept.†	Oct.†	Nov.†	Dec.†
Northwestern Division.*	Av. for Tab. Dis. Rep. Pres.	33	30	34	47	39	38	43	43	48	52	49	41	48	52
	Brain, Inflammation of	3	5	0	20	0	7	0	0	7	13	0	0	0	0
	Bowels, Inflammation of	9	9	7	0	25	13	0	0	21	25	0	13	0	0
	Bronchitis	60	53	53	60	67	80	38	38	36	38	38	63	38	70
	Cerebro-spinal Meningitis	3	3	20	0	0	7	0	0	0	0	0	0	0	0
	Cholera Infantum	23	13	7	0	0	0	0	0	21	75	25	50	13	0
	Cholera Morbus	23	23		0	17	13	38	13	43	63	25	25	50	20
	Consumption, Pulmonary	36	45		47	33	33	50	50	71	50	38	50	50	50
	Croup, Membranous	8	8	/	13	17	7	0	13	0	0	0	0	0	0
	Diphtheria	18	11	7	0	17	20	25	0	0	0	0	13	38	20
	Diarrhea	60	53	20	53	0	47	50	63	79	88	50	75	75	70
	Dysentery	31	30	13	33	25	0	38	0	43	50	38	50	50	50
	Erysipelas	37	31	47	27	33	53	38	13	43	63	0	25	0	0
	Fever, Intermittent	81	73	60	67	50	67	100	75	100	88	63	63	75	80
	Fever, Remittent	37	31	13	7	0	33	25	25	29	50	63	50	75	50
	Fever, Typhoid (enteric)	9	6	13	0	0	0	0	0	0	0	25	13	25	10
	Fever, Typho-malarial	32	19	27	47	33	27	0	0	0	13	0	38	25	0
	Influenza	48	54	73	60	58	53	50	50	57	50	38	38	50	50
	Kidney, Inflammation of	48	48	87	93	42	40	50	50	57	50	0	38	13	0
	Measles	16	5	13	20	0	7	0	0	7	0	0	0	0	0
	Neuralgia	74	77	87	73	58	80	100	88	93	88	100	50	50	50
	Pneumonia	38	44	67	67	75	67	13	38	21	38	0	0	38	50
	Puerperal Fever	6	5	0	0	8	27	13	0	0	0	0	0	0	0
	Rheumatism	73	66	53	80	67	73	38	50	71	50	75	50	88	80
	Scarlatina	24	10	27	20	25	0	0	0	0	0	0	25	13	0
	Small-pox	1	0	0	0	0	0	0	0	0	0	0	0	0	0

14

	Tonsilitis	46	54	50	42	88	65	69	57	56	38	30	53	69	53	59	60	60	67	67	53	25	38	57	50	63	63	100	80
	Whooping-cough	24	30	25	33	50	41	31	29	28	25	40	40	25	0	22	7	7	0	33	27	0	0	0	0	0	0	0	0
Northern Division.* / Northeastern Division.*	Av. for Tab. Dis. Rep. Pres.	21	13	28	23	24	27	32	20	17	23	34	25	30	33	32	23	56	47	42	35	29	30	29	36	31	34	37	28
	Brain, Inflammation of	2	2	0	0	0	0	0	0	0	0	0	0	17	7	4	6	25	0	15	21	0	7	0	0	0	0	0	5
	Bowels, Inflammation of	2.9	0.7	0	0	0	0	0	0	0	0	0	7	0	0	24	23	38	13	15	21		47	30	27	20	25	27	11
	Bronchitis	53	23	27	12	20	40	33	20	0	0	20	29	33	33	83	66	100	50	85	79	44	67	55	53	73	56	67	74
	Cerebo-spinal Meningitis	2.4	0.7	0	0	10	0	0	0	0	0	0	0	0	0	4	3	0	0	0	0	6	0	5	0	13	0	0	5
	Cholera Infantum	4	4	0	0	0	0	0	7	0	18	0	0	17	7	12	5	0	0	0	0	0	0	20	27	0	6	0	0
	Cholera Morbus	4	4	0	0	0	0	0	7	11	9	0	0	17	0	15	7	0	0	0	0	0	13	25	40	0	0	0	0
	Consumption, Pulmonary	15	25	0	25	30	47	25	13	0	18	40	29	33	47	70	52	50	63	62	58	44	53	55	47	67	50	60	
	Croup, Membranous	1	0	0	0	0	0	0	0	0	0	0	0	0	0	11	3	0	0	8	0	0	0	5	0	7	0	0	11
	Diphtheria	10	17	18	0	10	27	0	0	33	18	20	7	17	33	9	20	25	13	0	0	6	7	50	20	27	44	20	16
	Diarrhea	41	7	0	0	10	0	0	20	6	36	10	7	0	0	71	44	0	25	46	42	44	40	50	67	60	50	47	26
	Dysentery	23.9	0.7	0	0	0	0	0	0	0	0	10	0	0	0	27	13	0	13	23	16	13	13	5	33	7	0	20	16
	Erysipelas	9	6	0	12	30	0	17	7	6	0	0	0	0	7	25	18	50	38	38	21	31	13	10	0	7	0	13	26
	Fever, Intermittent	26	26	9	25	10	13	17	27	28	64	50	29	33	20	17	26	25	0	0	11	38	20	55	20	47	25	27	21
	Fever, Remittent	5	3	0	0	0	7	0	7	6	18	0	0	0	0	30	12	0	0	0	5	13	0	10	20	13	25	27	21
	Fever, Typhoid (enteric)	9	12	0	25	30	13	17	0	28	9	0	14	8	0	4	0.6	0	0	0	0	0	0	0	0	0	0	7	0
	Fever, Typho-malarial	11	2	27	0	0	0	0	0	0	0	0	0	0	0	11	4	0	0	0	0	13	13	5	0	20	0	0	0
	Influenza	36	13	0	12	30	27	33	27	0	9	30	0	0	0	30	31	50	50	31	26	25	27	25	27	33	25	47	26
	Kidney, Inflammation of	10	7	18	25	0	13	0	20	0	9	0	7	0	0	49	18	0	0	23	21	13	20	25	33	13	31	13	5
	Measles	14	0	0	0	0	0	0	0	0	0	0	0	0	0	11	6	0	38	31	5	0	0	0	0	20	0	0	0
	Neuralgia	62	39	55	0	30	47	50	40	17	36	50	57	50	33	88	75	100	100	85	84	69	60	70	67	67	69	73	79
	Pneumonia	23	11	27	0	20	27	0	20	11	0	0	0	0	13	38	30	63	100	77	37	38	33	0	7	13	13	7	37
	Puerperal Fever	9	5	0	0	30	7	0	0	11	0	0	0	0	7	4	4	0	0	8	11	19	0	5	0	0	6	0	0
	Rheumatism	65	45	36	12	20	53	75	73	39	55	30	36	50	40	82	66	75	88	85	68	69	73	65	67	67	50	67	47
	Scarlatina	5	7	9	25	0	0	0	0	11	0	0	14	0	27	10	7	0	0	0	0	25	7	25	7	0	6	0	0
	Small-pox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tonsilitis	28	33	55	63	40	27	25	13	0	18	80	43	42	33	77	57	75	63	69	74	56	27	50	47	33	56	67	74
	Whooping-cough	11	21	0	12	40	33	0	7	17	9	0	43	42	33	6	3	0	13	8	0	0	0	0	0	13	0	0	11

*, †, ᵈ. See page 101. ‡ Inflammation of kidney was not compiled until 1884. For inflammation of brain and inflammation of bowels, an average for the 6 years 1880–85; for neuralgia and tonsilitis, an average for the 7 years 1879–85; for other diseases, and for the average line, an average for the 9 years 1877–85. For the northern division 1882–85. For the northeastern division 1883–85.

TABLE 2.—CONTINUED.—*Diseases in the Western, Northern Central, Bay and Eastern, and the Central Divisions of the State, for the Years 1877–1885, and by Months in 1885, indicating what Per Cent of the Weekly Reports Received Stated the Presence of the Diseases Named.*[d]

Western Division.*

Diseases.	'77-85.‡	1885.†	Jan.†	Feb.†	March.†	April.†	May.†	June.†	July.†	Aug.†	Sept.†	Oct.†	Nov.†	Dec.†
Av. for Tab. Dis. Rep. Pr.	32	29	31	37	36	36	34	35	36	37	33	30	30	27
Brain, Inflammation of	5	4	0	0	0	0	4	3	7	0	7	4	0	7
Bowels, Inflammation of	16	16	8	5	5	9	25	23	18	21	2	17	19	22
Bronchitis	55	43	50	62	53	36	63	46	33	34	40	33	45	46
Cerebro-spinal Meningitis	4	5	0	0	0	0	8	9	16	11	4	7	2	2
Cholera Infantum	17	11	8	0	0	0	21	11	27	37	9	4	0	0
Cholera Morbus	[illegible]	18	4	0	0	9	16	17	33	50	27	15	4	11
Consumption, Pulmonary	50	52	50	52	58	82	58	51	58	58	56	46	47	35
Croup, Membranous	6	4	4	10	0	0	13	3	0	0	0	9	9	6
Diphtheria	29	18	0	5	11	18	8	14	11	16	24	33	19	26
Diarrhea	47	44	29	14	21	45	38	57	71	84	62	41	23	19
Dysentery	27	18	12	0	0	9	8	23	40	39	27	11	11	4
Erysipelas	31	36	38	48	32	27	4	40	38	21	40	30	51	41
Fever, Intermittent	76	75	33	33	42	55	100	100	100	89	93	70	70	59
Fever, Remittent	67	56	42	62	63	73	67	63	60	63	56	59	38	50
Fever, Typhoid (enteric)	11	4	0	0	0	0	4	0	0	0	5	11	11	2
Fever, Typho-malarial	27	26	21	19	21	18	29	14	0	24	47	46	28	20
Influenza	47	43	46	71	42	55	42	37	29	29	42	50	51	46
Kidney, Inflammation of	20	19	21	5	5	9	16	11	27	26	15	26	21	22
Measles	13	7	0	0	0	0	29	26	24	0	0	0	2	2
Neuralgia	71	73	71	71	68	45	83	89	69	71	76	70	70	72
Pneumonia	41	25	21	14	26	45	25	37	27	16	16	24	23	33
Puerperal Fever	7	5	0	0	0	9	0	0	2	3	2	4	6	22
Rheumatism	61	62	54	57	68	64	67	80	73	63	62	54	55	56
Scarlatina	26	22	38	43	16	27	29	34	18	11	18	26	17	13
Small-pox	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Northern Central Division.*

Diseases.	'77-85.‡	1885.†	Jan.†	Feb.†	March.†	April.†	May.†	June.†	July.†	Aug.†	Sept.†	Oct.†	Nov.†	Dec.†
Av. for Tab. Dis. Rep. Pr.	30	33	43	54	90	61	78	77	56	49	52	61	63	42
Brain, Inflammation of	3	6	0	0	0	20	0	0	38	13	0	0	0	0
Bowels, Inflammation of	5	4	0	0	0	0	0	0	0	13	13	0	0	10
Bronchitis	54	81	50	86	100	100	100	100	63	63	100	86	83	80
Cerebro-spinal Meningitis	10	10	0	0	0	40	50	75	0	0	13	0	0	0
Cholera Infantum	11	5	13	0	0	0	25	0	13	13	0	0	0	0
Cholera Morbus	17	13	0	0	0	0	50	50	38	13	13	14	0	0
Consumption, Pulmonary	37	76	50	57	100	80	100	100	100	100	75	57	83	50
Croup, Membranous	11	11	38	29	75	20	0	0	0	0	0	0	0	0
Diphtheria	34	3	0	0	0	0	0	0	0	0	0	0	0	20
Diarrhea	48	56	38	43	0	60	100	100	75	88	88	57	33	10
Dysentery	18	10	13	0	0	0	25	75	13	25	0	0	0	0
Erysipelas	32	32	13	14	75	80	75	75	38	0	13	0	33	40
Fever, Intermittent	70	86	75	57	100	80	100	100	100	100	88	86	100	70
Fever, Remittent	59	67	50	57	100	80	100	100	63	50	63	71	67	60
Fever, Typhoid (enteric)	10	3	25	0	0	0	0	0	0	0	0	0	0	0
Fever, Typho-malarial	32	28	38	57	25	80	75	25	0	13	13	14	17	20
Influenza	12	14	50	43	0	20	0	0	0	0	0	0	0	30
Kidney, Inflammation of	4	6	25	43	0	0	0	0	0	0	0	0	0	0
Measles	18	3	0	0	0	20	0	0	0	0	0	0	0	10
Neuralgia	57	85	88	86	100	60	100	100	63	63	100	100	100	80
Pneumonia	34	35	50	57	100	80	75	25	13	0	13	0	33	40
Puerperal Fever	5	3	12	0	0	0	0	0	0	0	0	0	0	10
Rheumatism	59	81	63	57	100	80	100	100	75	88	88	100	100	60
Scarlatina	9	0	0	0	0	0	0	0	0	0	0	0	0	0
Small-pox	1	0	0	0	0	0	0	0	0	0	0	0	0	0

																Central Division.*													
	Tonsilitis	55	54	46	52	42	55	67	49	38	50	45	59	70	67	60	77	75	71	100	60	100	100	100	50	63	71	83	80
	Whooping-cough	15	3	0	0	0	0	0	9	4	5	5	4	0	2	16	28	50	57	100	80	0	25	0	0	38	14	17	0
Bay and Eastern Division.*	Av. for Tab. Dis. Rep. Pr.	34	26	38	39	41	42	27	28	24	26	25	25	24	25	27	26	27	33	29	31	29	26	27	28	25	26	24	27
	Brain, Inflammation of	7	9	14	26	30	27	11	14	3	6	6	6	1	4	5	4	3	0	5	5	4	7	6	6	2	3	5	2
	Bowels, Inflammation of	22	22	36	37	33	46	27	17	13	17	20	22	15	14	12	13	8	14	9	12	13	9	21	20	11	17	8	13
	Bronchitis	73	51	79	70	77	73	65	57	33	32	33	51	51	59	53	56	77	75	77	68	54	55	52	29	39	53	57	65
	Cerebro-spinal Meningitis	6	6	7	22	20	16	5	5	5	6	2	1	0	0	4	9	11	8	8	9	9	5	20	15	8	8	4	7
	Cholera Infantum	18	12	7	0	0	0	5	10	27	38	20	3	1	4	11	9	2	3	2	0	1	8	17	34	17	9	3	0
	Cholera Morbus	22	17	4	0	13	0	8	12	44	50	25	9	3	3	15	16	2	10	11	2	6	13	43	48	21	18	3	6
	Consumption, Pulmonary	71	52	71	74	73	73	65	69	40	35	37	51	46	53	61	56	56	63	69	82	66	71	53	46	41	44	49	55
	Croup, Membranous	11	6	25	26	20	14	3	2	0	0	7	3	4	1	3	2	8	2	5	2	1	1	1	1	1	3	1	2
	Diphtheria	30	13	29	15	3	0	8	19	12	12	18	14	13	11	23	10	2	6	8	6	6	4	8	18	11	19	10	13
	Diarrhea	52	51	32	30	57	46	38	45	73	83	63	43	34	36	42	43	21	32	36	28	31	43	64	74	62	48	34	27
	Dysentery	20	12	7	4	0	11	8	5	14	26	12	13	15	11	14	10	3	0	3	5	0	4	9	30	24	15	6	4
	Erysipelas	26	19	25	37	30	30	24	24	15	17	10	14	17	16	18	30	47	43	48	38	30	30	16	17	21	24	31	31
	Fever, Intermittent	81	56	57	52	60	73	51	60	53	58	57	52	55	56	74	63	53	51	53	66	74	78	74	70	64	64	57	53
	Fever, Remittent	49	34	43	41	47	43	27	40	33	27	36	32	35	23	48	34	24	21	36	42	36	33	27	37	38	40	38	31
	Fever, Typhoid (enteric)	9	7	4	4	0	0	0	10	1	11	8	9	15	7	12	5	11	6	6	3	0	0	0	2	9	10	8	3
	Fever, Typho-malarial	30	19	32	19	23	24	5	17	12	18	32	23	21	7	20	17	6	6	11	8	9	9	18	21	21	30	25	17
	Influenza	44	35	64	81	63	51	30	29	19	17	35	33	31	31	37	39	60	67	60	63	37	29	22	16	28	33	32	43
	Kidney, Inflammation of	26	21	32	15	37	30	32	24	18	11	10	17	18	30	21	19	21	30	31	26	27	25	14	11	12	16	14	18
	Measles	16	6	18	26	23	14	3	5	3	3	0	0	7	0	10	3	0	0	3	6	14	3	1	0	0	1	2	6
	Neuralgia	72	62	89	85	80	84	68	67	50	44	52	64	55	66	60	72	87	81	81	86	74	76	71	61	58	61	71	80
	Pneumonia	43	23	64	67	73	62	30	17	5	6	7	16	15	19	33	19	34	49	41	35	26	3	8	4	6	13	11	27
	Puerperal Fever	5	5	7	11	10	11	8	0	5	3	4	3	6	0	5	9	5	0	3	0	9	11	8	17	11	11	13	13
	Rheumatism	77	68	82	89	87	95	89	69	49	56	58	62	69	71	60	65	69	67	72	66	81	72	60	52	54	64	67	69
	Scarlatina	20	10	25	22	10	11	8	19	9	8	10	14	7	1	13	7	2	2	3	8	9	9	13	8	7	3	7	6
	Small-pox	1	0.5	0	7	3	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tonsilitis	43	47	75	52	60	57	41	48	37	39	48	43	42	50	41	50	60	62	67	58	47	45	30	35	41	52	56	61
	Whooping-cough	27	26	57	56	50	35	19	19	19	32	27	22	15	7	18	10	5	0	5	0	0	5	16	20	12	10	9	17

*, †, d. See page 101. ‡ Inflammation of kidney was not compiled until 1884. For inflam. of brain, and inflam. of bowels, an average for the 6 years 1880-5; for neuralgia and tonsilitis, an av. for the 7 years 1879-85; for other diseases, and for the av. line, an av. for the 9 years 1877-85.

TABLE 2.—CONTINUED.—*Diseases in the Southwestern and Southern Central Divisions of the State, for the years 1877–1885, and by Months in 1885,—Indicating what Per Cent of the Weekly Reports Received Stated the Presence of the Diseases Named.*[d]

Div.* Southwestern Division.*

Diseases.	'77-85‡	1885.†	Jan.†	Feb.†	March.†	April.†	May.†	June.†	July.†	Aug.†	Sept.†	Oct.†	Nov.†	Dec.†
Av. for Tab. Dis. Rep. Pr.	29	27	54	50	53	48	31	26	30	31	27	29	32	33
Brain, Inflammation of	3.6	0.7	6	0	0	0	0	0	0	0	2	0	2	0
Bowels, Inflammation of	10	11	6	6	13	5	4	12	9	16	9	8	21	13
Bronchitis	54	62	88	100	100	95	48	53	44	39	50	57	69	78
Cerebro-spinal Meningitis	2	2	0	0	0	0	0	0	4	0	7	2	2	0
Cholera Infantum	20	13	0	0	0	0	0	9	18	35	24	16	8	2
Cholera Morbus	15	16	6	6	6	0	4	18	38	35	30	8	4	2
Consumption, Pulmonary	73	62	75	75	75	74	70	68	58	47	50	59	63	67
Croup, Membranous	4	6	31	19	19	2	0	0	0	4	2	4	4	11
Diphtheria	14	11	0	0	0	0	0	3	0	6	15	16	27	29
Diarrhea	39	36	0	25	13	0	19	41	62	61	61	35	25	13
Dysentery	13	11	0	0	6	0	4	6	9	27	31	14	6	2
Erysipelas	22	28	31	25	19	10	26	12	36	33	28	20	33	42
Fever, Intermittent	83	77	100	94	100	100	81	74	73	82	80	75	63	58
Fever, Remittent	52	39	38	19	69	53	37	21	36	47	39	43	44	36
Fever, Typhoid (enteric)	6	6	0	0	0	5	4	6	7	4	4	8	17	4
Fever, Typho-malarial	21	18	13	19	0	5	22	24	16	14	17	20	21	22
Influenza	45	43	94	100	100	95	33	12	18	24	31	29	52	55
Kidney, Inflammation of	14	16	0	31	0	0	15	15	11	20	17	24	21	18
Measles	10	0.7	0	0	0	0	4	0	0	0	4	0	0	0
Neuralgia	75	81	100	100	100	79	96	71	73	67	80	75	77	89
Pneumonia	31	23	75	69	69	58	30	15	4	2	6	4	19	42
Puerperal Fever	2	1	0	0	0	0	4	3	2	0	2	0	0	2
Rheumatism	75	82	100	94	100	100	81	79	84	73	69	71	92	87
Scarlatina	14	11	13	13	38	21	0	15	13	10	4	16	4	11
Small-pox	0.8	2	0	0	0	5	15	12	0	0	0	0	0	0
Tonsilitis	44	48	81	69	56	47	41	21	27	22	43	51	69	75
Whooping-cough	15	11	0	31	19	0	15	12	13	10	9	8	21	5

Div.* Southern Central Division.*

Diseases.	'77-85.‡	1885.†	Jan.†	Feb.†	March.†	April.†	May.†	June.†	July.†	Aug.†	Sept.†	Oct.†	Nov.†	Dec.†
Av. for Tab. Dis. Rep. Pr.	29	29	34	34	36	30	27	27	29	32	33	30	32	30
Brain, Inflammation of	4	6	8	6	8	4	1	3	7	8	5	5	5	4
Bowels, Inflammation of	15	22	16	19	33	19	28	22	19	26	14	22	28	26
Bronchitis	66	58	75	78	70	68	58	53	51	38	47	51	67	69
Cerebro-spinal Meningitis	4	4	6	8	20	0	1	3	0	0	4	6	0	4
Cholera Infantum	11	11	2	2	3	7	7	6	22	35	18	8	3	1
Cholera Morbus	19	20	0	3	5	13	11	21	43	60	28	6	9	2
Consumption, Pulmonary	63	62	66	75	85	65	54	54	61	56	60	58	65	64
Croup, Membranous	14	3	18	8	3	2	0	0	0	0	1	0	2	6
Diphtheria	15	13	20	14	15	22	9	16	13	6	13	13	10	11
Diarrhea	46	52	46	40	48	38	41	40	71	83	76	47	37	32
Dysentery	17	17	5	6	10	6	8	9	16	39	46	15	9	4
Erysipelas	20	18	20	27	25	25	29	15	19	10	10	14	17	20
Fever, Intermittent	80	65	69	75	67	74	64	78	67	64	64	66	60	49
Fever, Remittent	56	46	51	52	67	56	45	44	37	48	45	45	46	40
Fever, Typhoid (enteric)	9	9	11	8	2	3	3	2	7	5	10	15	23	18
Fever, Typho-malarial	19	20	21	27	25	10	8	7	12	12	27	33	32	19
Influenza	36	30	54	51	40	37	32	22	16	17	29	28	34	46
Kidney, Inflammation of	20	19	21	17	22	16	18	18	20	20	21	16	17	19
Measles	11	4	2	3	15	16	4	6	7	0	0	0	0	0
Neuralgia	69	73	75	84	85	74	67	67	67	67	70	69	80	81
Pneumonia	37	36	62	81	80	65	39	26	13	12	14	25	37	41
Puerperal Fever	3	3	2	13	16	3	1	2	2	3	0	0	4	3
Rheumatism	70	78	82	78	92	85	79	73	71	65	74	82	85	82
Scarlatina	16	13	26	32	26	22	12	20	6	4	1	4	16	13
Small-pox	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0
Tonsilitis	50	53	74	65	63	52	58	48	45	40	41	51	62	63
Whooping-cough	18	10	8	6	2	3	7	7	13	8	11	9	16	19

*, †, [d]. See page 101. ‡ Inflammation of kidney was not compiled until 1884. For inflammation of brain and inflammation of bowels, an average for the 6 years 1880–85; for neuralgia and tonsilitis an average for the 7 years 1879–85; for other diseases and for average line an average for the 9 years 1877–85.

ABLE 2.—CONTINUED.—*Diseases in the Southeastern Division of the State, for the years 1877–1885, and by Months in 1885,—Indicating what Per Cent of the Weekly Reports Received Stated the Presence of the Diseases Named.*[d]

Div.*	Diseases.	Southeastern Division.*													
		1877-85‡	'885†.	Jan.†	Feb.†	Mar.†	Apr.†	May.†	June.†	July.†	Aug.†	Sept.†	Oct.†	Nov.†	Dec.†
	Av. for Tabulated Dis. Reported Present	36	27	31	32	32	34	24	25	25	28	30	27	27	26
Southeastern Division.*	Brain, Inflammation of	16	11	14	15	17	26	9	12	11	8	7	12	7	9
	Bowels, Inflammation of	22	16	11	15	14	12	16	24	12	18	17	15	12	20
	Bronchitis	68	62	80	76	97	91	61	52	45	59	53	52	61	66
	Cerebro-spinal Meningitis	8	11	20	24	23	23	9	6	10	8	12	11	5	6
	Cholera Infantum	17	13	0	0	0	0	4	9	29	34	27	18	7	7
	Cholera Morbus	24	22	11	3	11	16	14	25	44	41	31	12	11	10
	Consumption, Pulmonary	82	69	74	76	69	70	56	67	70	67	77	74	64	66
	Croup, Membranous	13	9	14	12	11	12	5	12	8	5	7	7	14	10
	Diphtheria	33	22	26	18	17	37	19	21	19	21	17	25	24	22
	Diarrhea	53	43	14	24	20	19	39	39	57	80	68	39	33	32
	Dysentery	27	19	14	9	6	14	7	16	15	37	30	28	20	14
	Erysipelas	34	26	31	44	43	40	33	31	19	12	17	20	25	33
	Fever, Intermittent	73	51	26	32	34	37	56	58	61	59	64	56	46	39
	Fever, Remittent	46	30	29	29	34	23	21	33	28	33	43	32	33	18
	Fever, Typhoid (enteric)	25	16	20	12	11	12	9	10	10	14	30	21	24	15
	Fever, Typho-malarial	27	9	0	0	3	0	12	4	3	12	20	16	12	5
	Influenza	45	23	49	41	37	35	16	7	8	12	26	28	38	26
	Kidney, Inflammation of	23	19	11	24	20	12	12	19	12	20	23	25	22	21
	Measles	19	9	11	12	11	16	14	9	11	5	6	5	8	7
	Neuralgia	58	50	60	65	60	65	40	48	43	43	52	39	54	55
	Pneumonia	45	25	37	47	51	44	28	10	11	16	19	21	30	28
	Puerperal Fever	10	11	11	12	17	23	9	15	9	7	10	12	7	9
	Rheumatism	74	62	71	85	94	81	60	66	51	51	43	53	64	69
	Scarlatina	30	17	14	15	14	19	23	9	20	13	10	24	18	22
	Small-pox	4.1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tonsilitis	48	41	49	41	51	37	46	42	38	36	36	31	50	47
	Whooping-cough	29	23	49	29	40	42	18	10	18	21	24	25	16	18

*, †, d. See page 101. ‡ Inflammation of kidney was not compiled until 1884. For inflammation of brain and inflammation of bowels, an average for the 6 years 1880-85; for neuralgia and tonsilitis an average for the 7 years 1879-85; for other diseases and for average line an average for the 9 years 1877-85.

TABLE 4.—*A Summary for the Year 1885, relative to Diseases in each of the Eleven Divisions of the State,†—indicating the prevalence as regards both Time and Area.*

Diseases.	Western Division.*				Bay and Eastern.*				Central Division.*				Southwestern Div.*				S. Central Div.*				Southeastern Div.*			
	Per Cent of Observers Reporting Presence of.[b]	Av. Per Ct. of Weeks Reported Present where Present.[c]	Per Cent of Reports Stating Pres. of.[d]	Av. Order of Prevalence where Pres.[e]	Per Cent of Observers Reporting Presence of.[b]	Av. Per Ct. of Weeks Reported Present where Present.[c]	Per Cent of Reports Stating Pres. of.[d]	Av. Order of Prevalence where Pres.[e]	Per Cent of Observers Reporting Presence of.[b]	Av. Per Ct. of Weeks Reported Present where Present.[c]	Per Cent of Reports Stating Pres. of.[d]	Av. Order of Prevalence where Pres.[e]	Per Cent of Observers Reporting Presence of.[b]	Av. Per Ct. of Weeks Reported Present where Present.[c]	Per Cent of Reports Stating Pres. of.[d]	Av. Order of Prevalence where Pres.[e]	Per Cent of Observers Reporting Presence of.[b]	Av. Per Ct. of Weeks Reported Present where Present.[c]	Per Cent of Reports Stating Pres. of.[d]	Av. Order of Prevalence where Pres.[e]	Per Cent of Observers Reporting Presence of.[b]	Av. Per Ct. of Weeks Reported Present where Present.[c]	Per Cent of Reports Stating Pres. of.[d]	Av. Order of Prevalence where Pres.[e]
Average for Tabulated Diseases Reported Present	44	65	20	4.0	37	68	26	4.0	39	66	26	3.3	37	69	27	3.5	40	71	29	3.9	39	69	27	4.4
Brain, Inflammation of	10	32	4	5.1	16	54	9	7.5	13	29	4	4.0	3	23	0.7	5.0	14	40	6	6.1	18	60	11	8.2
Bowels, Inflammation of	34	45	16	5.6	34	62	22	5.6	28	46	13	4.3	27	41	11	3.4	38	61	22	5.1	28	57	16	6.8
Bronchitis	60	71	43	3.8	63	83	51	2.9	75	75	56	3.3	70	85	.62	4.1	68	84	58	3.1	79	77	62	2.5
Cerebro-spinal Meningitis	17	31	5	6.2	12	46	6	7.9	19	51	9	4.4	5	35	2	5.6	7	59	4	6.3	14	79	11	12.8
Cholera Infantum	21	49	11	4.9	24	49	12	4.6	19	44	9	4.2	22	55	13	3.7	22	50	11	4.8	22	56	13	5.6
Cholera Morbus	34	50	18	5.0	31	56	17	4.5	34	49	16	4.5	33	48	16	3.4	34	55	20	3.8	36	58	22	5.7
Consumption, Pulmonary	63	80	52	4.3	58	89	52	4.0	68	82	56	3.5	73	84	62	5.1	72	86	62	4.4	75	91	69	3.1
Croup, Membranous	10	45	4	4.8	12	52	6	6.0	8	27	2	4.1	12	52	6	4.1	6	44	3	5.5	14	69	9	10.0
Diphtheria	35	51	18	4.8	26	50	13	4.8	22	46	10	3.6	19	58	11	3.2	23	55	13	6.2	38	56	22	4.4
Diarrhea	66	66	44	4.0	73	71	51	3.4	65	66	43	3.1	56	64	36	3.7	71	73	52	3.2	63	66	43	3.1
Dysentery	33	51	18	5.3	26	47	12	5.8	21	46	10	3.3	25	45	11	3.0	30	54	17	4.4	32	59	19	7.0
Erysipelas	59	59	36	5.0	34	54	19	5.1	54	55	30	3.9	47	60	28	4.2	35	51	18	4.9	46	57	26	4.8
Fever, Intermittent	84	88	75	1.8	73	77	56	2.4	79	79	63	2.2	88	85	77	2.5	77	84	65	2.9	66	76	51	2.6
Fever, Remittent	73	76	56	2.8	48	70	34	3.6	51	66	34	2.9	59	66	39	3.1	63	73	46	3.6	46	65	30	2.8
Fever, Typhoid (enteric)	11	33	4	4.4	12	60	7	3.6	11	50	5	3.7	15	37	6	2.8	17	53	9	5.1	26	62	16	5.8
Fever, Typho-malarial	39	64	26	3.7	29	65	19	5.3	28	58	17	4.0	30	58	18	3.6	31	63	20	5.1	17	52	9	3.2
Influenza	64	68	43	3.1	48	70	35	2.9	54	71	39	1.9	53	80	43	2.8	45	70	30	2.7	35	68	23	3.5
Kidney, Inflammation of	37	52	19	4.7	34	59	21	4.7	33	58	19	3.8	31	54	16	3.3	31	60	19	4.8	28	68	19	6.0
Measles	14	48	7	5.2	12	47	6	6.6	7	40	3	3.3	2	33	0.7	7.5	7	52	4	6.2	12	74	9	11.2
Neuralgia	97	82	73	2.6	78	79	62	2.8	85	85	72	2.6	88	91	81	2.6	85	85	73	2.7	71	70	50	2.9
Pneumonia	56	42	25	4.5	36	64	23	5.1	37	51	19	4.0	37	60	23	4.4	51	70	36	4.5	40	63	25	4.2
Puerperal Fever	11	46	5	6.2	13	37	5	6.5	20	47	9	4.1	5	25	1	2.8	8	40	3	6.6	16	65	11	11.9
Rheumatism	79	78	62	3.8	83	81	68	3.4	77	85	65	2.9	97	84	82	2.8	91	86	78	3.0	77	79	62	3.3
Scarlatina	39	56	22	4.8	20	51	10	4.8	12	.55	7	3.5	19	56	11	5.1	26	49	13	5.8	28	60	17	5.4
Small-pox	0	0	0	0	1	38	0.5	9.0	0	0	0	0	3	69	2	8.0	0	0	0	0	0	0	0	0
Tonsilitis	85	63	54	4.0	69	68	47	3.7	74	68	50	3.4	70	67	48	3.8	68	77	53	3.5	64	63	41	2.9
Whooping-cough	6	48	3	7.7	38	68	26	3.6	13	72	10	3.3	15	73	11	3.2	16	60	10	4.0	34	67	23	5.

* For counties in each division see Exhibit I, page 87. [b], [c], [d], [e], See foot-notes with these marks in Table 2, page 102–5.
† This page includes the Six Divisions of the State from which the most Weekly Reports were received.

TABLE 4.—CONTINUED.†

Diseases.	Upper Peninsular Div.*				Northwestern Div.*				Northern Div.*				Northeastern Div.*				Northern Central Div.*			
	Per Cent of Observers Reporting Presence of.[b]	Av. Per Ct. of Weeks Reported Present where Present.[c]	Per Cent of Reports Stating Pres. of.[d]	Av. Order of Prevalence where Pres.[e]	Per Cent of Observers Reporting Presence of.[b]	Av. Per Ct. of Weeks Reported Present where Present.[c]	Per Cent of Reports Stating Pres. of.[d]	Av. Order of Prevalence where Pres.[e]	Per Cent of Observers Reporting Presence of.[b]	Av. Per Ct. of Weeks Reported Present where Present.[c]	Per Cent of Reports Stating Pres. of.[d]	Av. Order of Prevalence where Pres.[e]	Per Cent of Observers Reporting Presence of.[b]	Av. Per Ct. of Weeks Reported Present where Present.[c]	Per Cent of Reports Stating Pres. of.[d]	Av. Order of Prevalence where Pres.[e]	Per Cent. of Observers Reporting Presence of.[b]	Av. Per Ct. of Weeks Reported Present where Present.[c]	Per Cent of Reports Stating Pres. of.[d]	Av. Order of Prevalence where Pres.[e]
Average for Tabulated Diseases Reported Present	41	71	29	4.6	46	67	30	4.1	23	56	13	2.1	36	64	23	3.1	46	68	33	4.3
Brain, Inflammation of	40	41	16	6.3	16	30	5	2.6	5	33	2	1.0	19	32	6	4.3	15	42	6	5.3
Bowels, Inflammation of	35	64	23	7.2	31	29	9	3.9	3	25	0.7	3.0	56	41	23	4.0	15	21	4	2.3
Bronchitis	77	86	67	2.1	88	62	53	3.2	30	76	23	1.1	79	81	66	2.2	90	89	81	2.8
Cerebro-spinal Meningitis	7	25	2	7.7	6	57	3	2.0	3	25	0.7	3.0	9	28	3	3.5	20	44	10	7.0
Cholera Infantum	16	44	8	3.0	28	47	13	5.1	11	38	4	2.0	9	56	5	2.8	20	24	5	6.0
Cholera Morbus	30	49	16	5.5	50	45	23	4.3	16	23	4	2.0	19	38	7	3.5	30	42	13	5.7
Consumption, Pulmonary	77	89	70	4.3	47	95	45	7.5	35	69	25	3.6	67	77	52	3.9	85	87	76	4.5
Croup, Membranous	12	52	6	8.8	19	43	8	2.8	0	0	0	0	9	26	3	4.5	30	38	11	6.5
Diphtheria	30	55	18	7.2	22	48	11	8.4	30	52	17	2.4	33	63	20	3.6	10	20	3	5.0
Diarrhea	84	66	56	3.3	75	71	53	3.4	24	32	7	2.7	60	72	44	2.8	75	73	56	4.1
Dysentery	37	78	30	6.2	44	70	30	5.8	3	20	0.7	1.0	33	41	13	4.9	30	32	10	6.5
Erysipelas	35	51	18	7.3	63	51	31	5.1	16	35	6	2.3	37	50	18	3.0	60	51	32	6.3
Fever, Intermittent	23	56	12	3.0	91	80	73	2.1	38	69	26	1.5	47	53	26	2.0	95	90	86	2.5
Fever, Remittent	14	68	9	7.0	53	59	31	3.4	11	32	3	3.0	26	45	12	3.4	70	88	67	2.6
Fever, Typhoid (enteric)	30	56	17	6.2	16	40	6	8.6	27	43	12	2.5	2	33	0.6	1.0	5	50	3	10.0
Fever, Typho-malarial	7	23	2	3.0	31	64	19	4.6	3	75	2	1.0	9	47	4	2.8	60	42	28	6.3
Influenza	49	88	43	3.9	66	86	54	3.2	24	56	13	1.3	30	100	31	1.3	30	44	14	3.3
Kidney, Inflammation of	72	89	66	5.1	69	71	48	3.9	16	46	7	2.2	44	41	18	3.2	10	71	6	1.5
Measles	26	54	15	4.4	13	50	5	6.5	0	0	0	0	9	61	6	2.5	10	20	3	5.5
Neuralgia	77	82	63	3.1	91	85	77	3.9	54	71	39	1.9	86	86	75	2.8	95	88	85	3.1
Pneumonia	58	72	43	5.2	69	65	44	3.4	19	50	11	2.0	53	56	30	4.1	55	56	35	6.6
Puerperal Fever	7	54	4	7.0	13	43	5	3.5	11	37	5	1.8	14	32	4	2.8	10	22	3	4.0
Rheumatism	72	81	58	4.5	81	81	66	3.8	68	66	45	2.4	79	84	66	3.0	95	84	81	3.3
Scarlatina	30	46	13	4.1	16	65	10	10.4	14	52	7	1.4	12	63	7	2.6	0	0	0	0
Small-pox	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tonsilitis	74	74	54	3.8	81	76	60	4.4	51	64	33	2.1	81	71	57	2.1	100	77	77	4.3
Whooping-cough	35	86	30	3.7	16	45	7	2.2	38	53	21	2.4	9	33	3	4.8	40	65	28	5.9

* For counties in each division see Exhibit I, page 87. [b], [c], [d], [e], See foot-notes with these marks in Table 2, page 102–105.
† This page includes the Five Divisions of the State from which the fewest Weekly Reports were received.

WHAT DISEASES CAUSE MOST SICKNESS?

The answer to the above question for 1885 is given in Exhibit VI, which also affords a comparison of statements for the year 1885, with similar statements for preceding years. Until 1884 the reports show intermittent fever to have caused most sickness in Michigan, but in 1884 neuralgia heads the list, with rheumatism second and intermittent fever third. In 1885, neuralgia again heads the list with intermittent fever second and rheumatism third. The sickness from remittent fever has shown a gradual decrease since 1878, except a slight rise in 1884. In 1885 the sickness reported from the disease was much less than the average for the nine years 1877–85. This is shown in Exhibits II and XX, on pages 88 and 135.

Exhibit VII, on pages 114 and 115, contains for the eleven divisions of the State a statement as to what diseases caused most sickness in each division. The six divisions from which most reports were received are arranged on page 115, and the five divisions from which fewest reports were received are arranged on page 114.

EXHIBIT VI.—*Diseases from which there seems to have been the Most Sickness in Michigan in 1885, as indicated by the Per Cent of Weekly Reports Stating Presence of the Diseases, as studied in connection with the Average Order of Prevalence of said Diseases when Reported Present; also Order, Per Cent of Reports, and Average Order for the same Diseases in 1884, 1883, 1882, and 1881.*

	1885.				1884.			1883.			1882.			1881.		
	Order.*	Diseases in Order of Apparent Sickness in 1885, Most Prevalent one First.	Per Cent of Reports Stating Pres'ce of.d	Av. Order of Prevalence when Pres.e	Order.*	Per Cent of Reports Stating Pres'ce of.d	Av. Order of Prevalence when Present.e	Order.*	Per Cent of Reports Stating Pres'ce of.d	Av. Order of Prevalence when Present.e	Order.*	Per Cent of Reports Stating Pres'ce of.d	Av. Order of Prevalence when Present.e	Order.*	Per Cent of Reports Stating Presence of.d	Av. Order of Prevalence when Present.e
More Sickness than Average for 27 Diseases, in 1885.	1	Neuralgia	68	2.8	1	70	3.3	2	69	3.3	2	68	3.6	4	65	4.3
	2	Intermittent Fever	59	2.4	3	65	2.5	1	69	2.3	1	71	2.0	1	82	2.4
	3	Rheumatism	68	3.2	2	70	3.6	4	68	3.7	4	68	3.8	2	71	4.6
	4	Bronchitis	56	3.1	4	61	3.2	3	66	3.2	3	65	3.3	3	62	3.9
	5	Consumption	58	4.0	5	63	4.3	5	61	4.5	5	66	4.6	7	71	5.6
	6	Tonsilitis	50	3.5	7	50	3.7	7	50	3 9	9	47	3.9	8	48	4.5
	7	Diarrhea	46	3.3	6	52	3.3	6	49	3.7	7	48	3.8	6	52	3.9
	8	Influenza	34	2.9	9	41	3.3	8	43	3.2	8	40	3.1	9	35	3.5
	9	Remittent Fever	36	3.2	8	44	2.3	9	41	3.3	6	48	3.3	5	54	3.5
	(10)	Av. for 27 Diseases †	26	3.8	(10)	29	4.2	(11)	30	4.2	(11)	30	4.2	(11)	33	4.9
Less than said Average.	10	Pneumonia	27	4.4	10	29	4.5	10	33	4.7	10	39	4.4	10	41	5.4
	11	Erysipelas	24	4.6	12	26	5.2	12	25	5.5	15	22	5.5	17	23	6.2
	12	Inflammation of Kidney	21	4.4	11	26	5.0	....	....	....	....	....	....	....	....	....
	13	Whooping-cough	14	4.1	13	23	4.5	19	15	5.2	13	17	4.4	19	15	6.3
	14	Typho-malarial Fever	16	4.4	17	20	4.6	14	18	4.8	12	24	4.9	13	29	5.2
	15	Cholera Morbus	17	4.5	15	22	4.9	15	18	5.0	17	17	5.2	14	26	5.3

* Judging from the per cent of reports which stated presence of the diseases, in connection with the order of prevalence when prevalent.
† For 1883, '82 and '81 the average is for 26 diseases.
d This column states what per cent the number of reports stating presence of a disease is of the whole number of reports received for the time specified, from *all observers* in the State. It combines and states in a general way, an idea of the *time* a disease was prevalent, with an idea of the area of its prevalence.
e The disease having the greatest number of cases was to be marked 1 in the order; the disease having the next greatest number of cases, 2; and so on. Diseases not present were to be marked 0. The numbers in this column are found by dividing the totals of the Order of Prevalence columns, in Table 3 (omitted in this Report), by the number of men who reported the disease present. The column is, therefore, an average not for all the localities represented but only for those at which the given disease was reported present. The numbers in the "Average" lines for this column are found by dividing the sum of the totals in the order of prevalence columns, in Table 3, for all diseases reported present, by the sum of the numbers of men who reported the different diseases present, thus counting each man once for every disease he reported present. As a rule, small numbers in this column indicate the large prevalence of the disease, and *vice versa*; but the greater the number of diseases reported present by each observer, from week to week, the greater will be the "average" in this column.

EXHIBIT VII.—*In each of eleven Geographical Divisions* of the State, the fifteen Diseases from which there seems to have been the Greatest Amount of Sickness in 1885, as indicated by the Per Cent of Weekly Reports Stating Presence of each of 27 Leading Diseases, when studied in connection with the Average order of Prevalence of said diseases when reported present.*

	Order.†	Diseases in Order of Apparent Amount of Sickness, Most Prevalent one First.	Per Cent of Reports Stating Pres'nce of.[d]	Av. Order of Prevalence when Pres.[e]	Diseases in Order of Apparent Amount of Sickness, Most Prevalent one First.	Per Cent of Reports Stating Pres'nce of.[d]	Av. Order of Prevalence when Pres.[e]	Diseases in Order of Apparent Amount of Sickness, Most Prevalent one First.	Per Cent of Reports Stating Pres'nce of.[d]	Av. Order of Prevalence when Pres.[e]
		UPPER PENINSULAR DIV.*			NORTHWESTERN DIV.*			NORTHEASTERN DIV.*		
More Sickness than Av. for 27 Diseases.	1	Bronchitis	67	2.1	Intermittent Fever	73	2.1	Bronchitis	66	2.2
	2	Neuralgia	63	3.1	Neuralgia	77	3.9	Neuralgia	75	2.8
	3	Consumption	70	4.3	Rheumatism	66	3.8	Tonsilitis	57	2.1
	4	Diarrhea	58	3.3	Influenza	54	3.2	Influenza	31	1.3
	5	Tonsilitis	54	3.8	Bronchitis	53	3.2	Rheumatism	66	3.0
	6	Inflam. of Kidney	66	5.1	Diarrhea	53	3.4	Diarrhea	44	2.8
	7	Rheumatism	58	4.5	Tonsilitis	60	4.4	Intermittent Fever	26	2.0
	8	Influenza	43	3.9	Pneumonia	44	3.4	Typhoid Fever	0.6	1.0
	9	Whooping-cough	30	3.7	Inflam. of Kidney	48	3.9	Consumption	52	3.9
	10	Pneumonia	43	5.2	Remittent Fever	31	3.4	----	----	----
	(10)	----	----	----	----	----	----	Av. for 27 Diseases	23	3.1
	(11)	Av. for 27 Diseases	29	4.6	Av. for 27 Diseases	30	4.1	----	----	----
Less	10	----	----	----	----	----	----	Erysipelas	18	3.0
	11	Intermittent Fever	12	3.0	Whooping-cough	7	2.2	Measles	6	2.5
	12	Cholera Infantum	8	3.0	Erysipelas	31	5.1	Scarlet Fever	7	2.6
	13	Typho-mal. Fever	2	3.0	Cerebro-spin'l M'g's	3	2.0	Inflam. of Kidney	18	3.2
	14	Scarlet Fever	13	4.1	Cholera Morbus	23	4.3	Pneumonia	30	4.1
	15	Measles	15	4.4	Membranous Croup	8	2.8	Cholera Infantum	5	2.8

	Order.†	NORTHERN CENT. DIV.*	Per Cent	Av. Order	Order.	NORTHERN DIVISION.*	Per Cent	Av. Order
More Sickness than Av. for 27 Diseases.	1	Intermittent Fever	86	2.5	1	Neuralgia	39	1.9
	2	Neuralgia	85	3.1	2	Bronchitis	23	1.1
	3	Bronchitis	81	2.8	3	Rheumatism	45	2.4
	4	Rheumatism	81	3.3	4	Intermittent Fever	26	1.5
	5	Remittent Fever	67	2.6	5	Tonsilitis	33	2.1
	6	Tonsilitis	77	4.3	6	Influenza	13	1.3
	7	Consumption	76	4.5	7	Typho-malarial Fever	2	1.0
	8	Diarrhea	56	4.1	8	Inflammation of Brain	2	1.0
	9	Inflam. of Kidney	6	1.5	9	Dysentery	0.7	1.0
	(10)	Av. for 27 Diseases	33	4.3	10	Scarlet Fever	7	1.4
Less	10	Influenza	14	3.3	11	Whooping-cough	21	2.4
	11	Inflam. of Bowels	4	2.3	12	Pneumonia	11	2.0
	12	Pneumonia	35	6.6	(13)	Average for 27 Diseases	13	2.1
	13	Whooping-cough	28	5.9	13	Diphtheria	17	2.4
	14	Erysipelas	32	6.3	14	Puerperal Fever	5	1.8
	15	Typho-mal. Fever	28	6.3	15	Cholera Morbus	4	2.0

* For counties in each division see Exhibit I, page 89.
† Judging from the per cent of reports in connection with the "average order of prevalence where present." [d], [e]. See footnotes with these marks on page 113.

EXHIBIT VII.—Continued.

	Order.†	Diseases in Order of Apparent Amount of Sickness, Most Prevalent one First.	Per Cent of Reports Stating Pres'nce of.[d]	Av. Order of Prevalence when Pres.[e]	Diseases in Order of Apparent Amount of Sickness, Most Prevalent one First.	Per Cent of Reports Stating Pres'nce of.[d]	Av. Order of Prevalence when Pres.[e]	Diseases in Order of Apparent Amount of Sickness, Most Prevalent one First.	Per Cent of Reports Stating Pres'nce of.[d]	Av. Order of Prevalence when Pres.[e]
		Western Division.*			Central Div.*			Bay and East'n Div.*		
More Sickness than Av. for 27 Diseases.	1	Intermittent Fever	75	1.8	Intermittent Fever	63	2.2	Neuralgia	62	2.8
	2	Neuralgia	73	2.6	Neuralgia	72	2.6	Rheumatism	68	3.4
	3	Remittent Fever	56	2.8	Influenza	39	1.9	Intermittent Fever	56	2.4
	4	Rheumatism	62	3.8	Rheumatism	65	2.9	Bronchitis	51	2.9
	5	Tonsilitis	54	4.0	Bronchitis	56	3.3	Diarrhea	51	3.4
	6	Influenza	43	3.1	Consumption	56	3.5	Consumption	52	4.0
	7	Consumption	52	4.3	Diarrhea	43	3.1	Tonsilitis	47	3.7
	8	Bronchitis	43	3.8	Tonsilitis	50	3.4	Influenza	35	2.9
	9	Diarrhea	44	4.0	Remittent Fever	34	2.9	Remittent Fever	34	3.6
	10	Typho-mal. Fever	26	3.7	....	....	....	Whooping-cough	26	3.6
	(10)	....	....	....	Av. for 27 Diseases	26	3.3	....	....	....
	(11)	Av. for 27 Diseases	29	4.0	....	....	....	Av. for 27 Diseases	26	4.0
Less	10	....	....	....	Erysipelas	30	3.9	....	....	....
	11	Erysipelas	36	5.0	Dysentery	10	3.3	Inflam. of Kidney	21	4.7
	12	Pneumonia	25	4.5	Whooping-cough	10	3.3	Cholera Morbus	17	4.5
	13	Scarlet Fever	22	4.8	Inflam. of Kidney	19	3.8	Pneumonia	23	5.1
	14	Inflam. of Kidney	19	4.7	Measles	3	3.3	Typhoid Fever	7	3.6
	15	Diphtheria	18	4.8	Diphtheria	10	3.6	Erysipelas	19	5.1
		Southwestern Div.*			Southern-Cen. Div.*			Southeastern Div.*		
More Sickness than Av. for 27 Diseases.	1	Neuralgia	81	2.6	Neuralgia	73	2.7	Consumption	69	3.1
	2	Rheumatism	82	2.8	Rheumatism	78	3.0	Bronchitis	62	2.5
	3	Intermittent Fever	77	2.5	Intermittent Fever	65	2.9	Rheumatism	62	3.3
	4	Influenza	43	2.8	Bronchitis	58	3.1	Intermittent Fever	51	2.6
	5	Bronchitis	62	4.1	Diarrhea	52	3.2	Neuralgia	50	2.9
	6	Remittent Fever	39	3.1	Tonsilitis	53	3.5	Diarrhea	43	3.1
	7	Tonsilitis	48	3.8	Influenza	30	2.7	Tonsilitis	41	2.9
	8	Consumption	62	5.1	Consumption	62	4.4	Remittent Fever	30	2.8
	9	Diarrhea	36	3.7	Remittent Fever	46	3.6	Influenza	23	3.5
	10	....	....	....	....	....	....	Pneumonia	25	4.2
	(10)	Av. for 27 Diseases	27	3.5	Av. for 27 Diseases	29	3.9	....	....	....
	(11)	....	....	....	....	....	....	Av. for 27 Diseases	27	4.4
Less	10	Inflam. of Kidney	16	3.3	Pneumonia	36	4.5	....	....	....
	11	Dysentery	11	3.0	Cholera Morbus	20	3.8	Erysipelas	26	4.8
	12	Erysipelas	28	4.2	Whooping-cough	10	4.0	Diphtheria	22	4.4
	13	Cholera morbus	16	3.4	Dysentery	17	4.4	Whooping-cough	23	5.2
	14	Typho-mal. Fever	18	3.6	Inflam. of Kidney	19	4.8	Typho-mal. Fever	9	3.2
	15	Typhoid Fever	6	2.8	Inflam. of Bowels	22	5.1	Cholera Morbus	22	5.7

* For counties in each division see Exhibit I, page 89.

† Judging from the per cent of reports in connection with the "average order of prevalence where present." [d], [e]. See footnotes with these marks on page 113.

EXHIBIT VIII.—*Names of Stations where were made the Observations of Meteorological Conditions used in Exhibit X. and following exhibits, relative to Sickness and Meteorological Conditions in 1885; also the Temperature, Humidity, Cloudiness, Ozone, Velocity of Wind, or Atmospheric Pressure, at each Station for which Observations of the given condition are included in the summary statements relative to that condition in said exhibits.*

Stations.* (Those of U. S. Signal Service in italics.)	Temperature.		Humidity.		Per Cent. of Cloudiness.	Ozone.		Wind, Av. Velocity.	Atmospheric Pressure.		
									Range.		
	Av. Daily Range.	Average.	Relative.	Absolute.		Day.	Night.		Monthly.	Av. Daily.	Average.
Number of Stations included in Average	18	21	18	18	20	16	16	8	18	18	18
Average	18.78	42.36	76	3.14	57	2.92	3.47	9.4	.907	.209	29.164
Manistique	22.09	38.28	79	2.78	54	2.71	3.53	......	.920	.204	29.294
Escanaba	16.62	37.57	73	2.68	59	3.02	3.63	9.0	.922	.207	29.288
Traverse City	20.07	40.50	86	3.26	61	2.62	2.71	......	.937	.215	29.315
Mackinaw City	16.01	38.03	76	2.76	58	3.04	3.23	9.5	.862	.211	29.300
Alpena	17.33	37.83	80	2.87	56	3.39	5.05	9.2	.955	.216	29.291
Harrisville	21.52	41.01	61	2.61	59	4.37	5.02	......	.940	.227	29.262
Grand Haven	14.85	42.94	77	3.14	62	......	......	10.7	.884	.200	29.312
Reed City	24.83	40.24	64	2.70	62	2.77	3.52	......	.824	.207	28.916
Port Austin	......	41.69	......	......	......	2.67	3.85	......	......	......	......
Port Huron	16.40	41.75	80	3.20	55	2.76	2.96	8.8	.989	.220	29.298
Thornville	15.82	44.93	80	3.53	52	2.48	3.41	......	.944	.203	28.911
Agr'l College	19.36	42.90	81	3.32	58	......	......	......	.861	.198	29.066
Ionia	21.36	43.91	......	......	61	......	......	......	.930	.214	29.229
Lansing	18.43	43.01	77	3.23	56	2.83	3.07	9.5	.895	.202	29.041
Swartz Creek	19.61	42.67	77	3.19	55	3.20	3.66	......	.926	.213	29.147
Ann Arbor	16.07	43.40	79	3.21	60	2.86	2.93	9.1	.891	.199	28.991
Battle Creek	......	46.72	71	3.39	55	......	......	......	......	......	......
Kalamazoo	......	44.36	......	......	68	2.43	2.84	......	......	......	......
Marshall	19.49	46.04	77	3.59	54	3.47	3.18	......	.892	.206	29.005
Tecumseh	21.97	44.79	82	3.60	49	2.17	2.51	......	.833	.201	29.102
Detroit	16.25	46.94	73	3.51	53	......	......	9.8	.914	.212	29.290

* At the U. S. Signal Service Stations the observations of mean temperature, humidity, cloudiness, and atmospheric pressure were made at 7 A. M., 3 P. M., and 11 P. M., seventy-fifth meridian time, which is faster than local time, as follows: At Port Huron, 30 m.; at Detroit, 32 m.; at Alpena, 34 m.; at Grand Haven, 45 m.; at Escanaba, 48 m.; at Marquette, 49 m. At the other stations the observations of these conditions were made at 7 A. M., 2 P. M., and 9 P. M., local time. Observations of range of temperature were made with registering thermometers read and set at 11 P. M., at the Signal Service Stations; at 7 A. M. at other stations. For the ozone observations the test-paper was exposed from 7 A. M. to 2 P. M. for the day observations, and from 9 P. M. to 7 A. M. for the night observations. The velocity of wind was recorded by registering anemometers. These subjects are treated by months in 1885, and for previous years, in an article on Meteorological Conditions in Michigan in 1885, on pages 1-81 of this Report.

EXHIBIT IX.—*Showing Comparisons between the Averages of certain Meteorological Conditions at Stations in Michigan in 1885, with those in preceding Years. (Abstracted from Exhibit 5, page 24; Exhibit 8, page 30; Exhibit 11, page 36; Exhibit 13, page 37; Exhibit 18, page 48; Exhibit 22, page 56; Exhibits 24 and 25, page 57; Exhibit 27, page 64; Exhibit 28, page 66.)*

Meteorological Conditions.		Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average Temperature	In 1885 higher than Av. for 9 years, 1877-85	......	......	......	......	......	......	......	0.40	......	......	......	1.91	.31
	Lower	3.89	5.31	13.68	10.25	2.75	2.91	1.91	......	5.00	2.59	4.94	......	......
Av. Daily Range of Temp.	In 1885 more than Av. for 7 years, 1879-85	0.53	0.31	4.59	3.90	......	......	2.31	1.94	......	0.55	......	......	......
	Less	......	......	......	......	1.06	0.97	......	......	1.40	......	0.64	3.10	0.10
Absolute Humidity	In 1885 more than Av. for 9 years, 1877-85	......	......	......	......	......	......	......	......	......	......	......	0.17	......
	Less	0.31	0.24	0.57	0.55	0.17	0.30	0.40	0.01	0.56	0.42	0.55	......	0.05
Relative Humidity	In 1885 more than Av. for 8 years, 1878-85	1	......	......	1	4	1	......	......	4	0	3	3	0
	Less	......	1	0	......	......	......	2	1	......	......	......	......	......
Rainfall	In 1885 more than Av. for 9 years, 1877-85	......	0.88	......	......	......	0.25	......	......	2.22	......	......	......	0.11
	Less	1.91	......	0.80	1.21	0.25	......	0.64	0.83	......	0.44	0.45	0.43	......
Velocity of Wind	In 1885 greater than Av. for 4 years, 1882-85	......	0.5	......	......	0	......	0.4	......	0.4	0.4	......	......	0.7
	Less	0.2	......	1.2	0.1	......	0.8	......	0.6	......	......	1.0	0.5	......
Cloudiness	In 1885 greater than Av. for 9 years, 1877-85	1	......	......	......	6	2	......	......	11	......	1	15	3
	Less	......	1	4	9	......	......	6	1	......	1	......	......	......
Day Ozone	In 1885 more than Av. for 9 years, 1877-85	......	......	......	......	......	......	......	......	0.21	0.01	0.29	......	......
	Less	0.15	0.50	0.46	0.20	0.04	0.14	0.28	0.24	......	......	......	0.11	0.21
Night Ozone	In 1885 more than Av. for 9 years, 1877-85	0.26	......	......	......	0.37	0.36	0.26	0.49	1.01	0.70	0.50	0.06	......
	Less	......	0.42	0.40	0.37	......	......	......	......	......	......	......	......	0.05
Atmospheric Pressure	In 1885 greater than Av. for 9 years, 1877-85	......	......	......	.041	.082	......	.081	.028	.010	.032	......	......	......
	Less	.002	.005	.070	......	......	.032	......	......	......	......	.042	.086	.037

CLIMATE AND SICKNESS.*

Exhibit X, (page 120) is an attempt to learn something of the relations of bronchitis to meteorological conditions, by noting whether each condition was above or below its average for the year, in months when more, and in months when less bronchitis than the average for the year was reported. The months are arranged in order according to the amount of bronchitis reported, those in which most bronchitis was reported being placed first in the column, and those in which more bronchitis than the average was reported being placed above the average line, the others below that line. The conditions for each month are printed, in the proper columns, in the line for the month. The statements being thus arranged, it is easy to see whether the temperature, the velocity of the wind, or any other condition represented, was above its average for the year in months when more than the average amount of bronchitis was reported and in months when less bronchitis was reported. That the comparisons may the more readily be held in mind, propositions have been made concerning the relations of bronchitis to meteorological conditions (stated on this page), grouping the conditions into two classes. The letters *a* and *b*, in the Exhibit, mark exceptions to these propositions. It is not supposed that the propositions are in every case true; but they serve to bring out the evidence of the exhibit on the subject in question. This evidence is to be had by noting the number and force of the exceptions to the propositions, and also whether the exception is explained by facts shown in other columns. A summary of the evidence is presented in Exhibit XXIV, near the close of this article.

Exhibits and propositions similar to those relative to bronchitis, but relating to other diseases, are given on following pages. To prevent confusion it has been thought best not to change the statement of the propositions to fit the evidence concerning each disease,—except that they are differently stated for the summer diseases (beginning with the exhibit on diarrhea) and for the winter diseases (beginning with that on bronchitis), a somewhat arbitrary classification of the diseases treated, but one useful for the present purpose.

RELATIONS OF BRONCHITIS TO METEOROLOGICAL CONDITIONS.

PROPOSITION 1.—That in months when **more** than the average per cent of weekly reports stated the presence of Bronchitis the average daily range of temperature, the relative humidity of the atmosphere, the average per cent of cloudiness, the ozone, the average velocity of the wind, the monthly and the average daily range of the barometer, and the average daily pressure of the atmosphere were **greater** than the average for the year; and in months when **less** than the average per cent of reports stated the presence of Bronchitis these conditions were **less** than the average for the year. In Exhibit X, page 120, the letter *a* marks exceptions to this proposition for the year 1885.

PROPOSITION 2.—That in months when **more** than the average per cent of weekly reports stated the presence of Bronchitis, the average daily temperature, and the absolute humidity of the atmosphere were **less** than the average for the year; and in months when **less** than the average per cent of

*The remarks under this head are applicable, also, by changing the name of the disease to diseases treated in Exhibits XII, X.V, XV, XVI and XVII, on following pages. The meteorological data are from places indicated in Exhibit VIII, page 116.

reports stated the presence of Bronchitis these conditions were **greater** than the average for the year. In Exhibit X, page 120, the letter *b* marks exceptions to this proposition for months in 1885. As regards average daily temperature and absolute humidity there is for 1885 no exception to proposition 2 relating to Bronchitis.

PROPOSITION 3.—For those months which are not, as regards the absolute humidity of the atmosphere, exceptions to Proposition 2, it is true also that the quantity of vapor inhaled daily was **less** than the average, and the quantity exhaled daily in excess of that inhaled was **greater** than the average in months when **more** than the average per cent of reports stated presence of Bronchitis; and that **more** vapor was inhaled and a **less** excess exhaled daily in months when the per cent of reports stating presence of Bronchitis was **less** than the average.

EXHIBIT XI.—SICKNESS FROM BRONCHITIS, 1877–85.—*By Year and Months for each of the Nine Years 1877–85, Stating on what per cent of the Weekly Reports received Bronchitis was reported present, and comparing the Per Cents for 1885 with the Averages for corresponding Months in those Years.*

Years, etc.	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average 9 Years 1877-85	62	77	78	77	72	61	54	43	41	49	55	67	72
1877	55	76	72	72	65	45	31	25	22	37	48	71	77
1878	64	77	75	74	71	65	56	41	45	55	60	73	81
1879	64	83	87	83	78	65	54	40	41	50	59	65	77
1880	64	81	84	82	68	59	57	44	45	46	57	67	72
1881	62	86	86	80	78	62	53	38	37	44	44	66	68
1882	65	73	70	75	74	70	62	51	44	57	59	71	71
1883	66	77	80	82	76	70	62	56	53	53	57	61	69
1884	61	71	71	71	65	59	56	49	47	50	56	69	70
1885	56	73	74	76	73	56	52	44	39	45	51	58	64
In 1885 **Greater** than Av. 1877-85	......	....	....	....	1	....	....	1	....	....	....	....	....
In 1885 **Less** than Av. 1877-85	6	4	4	1	....	5	2	....	2	4	4	9	8

EXHIBIT X.—BRONCHITIS.—*Stating for the Year and for each Month of the Year 1885, what Per Cent of the weekly reports of Diseases stated Presence of Bronchitis, and what were the Meteorological Conditions as observed at Stations in Michigan.**

	Bronchitis.			Temperature, F.		Humidity of Air,§ Av. of 3 Daily Observations.		Vapor Inhaled and Exhaled, from Air Passages, by one Person in 24 Hours. Troy Ounces.			Ozone—Relative Scale of 10°.			Atmospheric Pressure, Inches Reduced to 32° F.		
	Months in order of Greatest Per Cent of Weekly Reports Stating Presence of.	Per Cent of Weekly Reports Stating Presence of.†	Av. Order of Prevalence where Present.†,‡.	Average Daily Range, by Registering Thermometers.	Average of 3 Daily Observations.	Relative Per Cent of Saturation.	Absolute—Grains of Vapor in a Cubic Foot of Air.	Inhaled.‖	Exhaled in Excess of that Inhaled.¶	Average Per Cent of Cloudiness.	Day Observation, 7 A. M. to 2 P. M.	Night Observation, 9 P. M. to 7 A. M.	Average Velocity of Wind, Miles per Hour, by Anemometer.	Range. Monthly, and for Year.	Range. Average Daily, by 3 Daily Observations.**	Average Pressure.
More than Av. Per Cent.	March	76	2.5	22.22	19.51	77	1.25	.78	10.90	a 51	3.31	3.75	10.2	1.068	.267	29.197
	February	74	2.4	22.94	10.21	80	.94	.59	11.09	a 57	3.05	3.65	a 9.0	1.160	.217	a 29.130
	January	73	2.5	a17.03	15.46	80	1.14	.71	9.97	67	a 2.88	3.49	11.8	1.356	.319	29.211
	April	73	2.7	a18.25	41.39	a 72	2.53	1.58	10.10	58	3.21	3.96	10.4	.930	.253	29.207
	December	64	2.6	a13.19	27.59	82	1.72	1.08	10.60	81	a 2.92	3.50	11.6	1.317	.314	a 29.148
	November	58	2.9	a11.53	38.14	82	2.50	1.56	10.12	84	a 2.87	a 3.38	9.9	a .800	a .181	a 29.105
Average		56	3.1	18.78	c 42.36	76	c 3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Av. Per Cent.	May	56	3.0	a19.72	53.32	69	3.62	2.26	9.42	50	a 2.96	a 3.68	9.0	.709	.148	29.105
	June	52	3.5	a22.73	63.39	70	4.90	3.06	8.62	41	2.61	3.20	8.7	.655	.165	a 29.195
	October	51	3.1	16.81	45.78	a 79	3.17	1.98	9.70	a 59	a 3.03	3.43	8.2	.809	.182	29.161
	September	45	3.3	a20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	.737	.173	a 29.209
	July	44	3.8	a22.09	71.13	71	6.12	3.83	7.85	41	2.47	3.00	7.6	.525	.118	29.150
	August	39	4.2	18.45	63.23	a 78	5.29	3.31	8.37	54	a 3.07	3.41	8.1	.808	.165	a 29.165

a An exception to the proposition that **more** than the average per cent of weekly reports stated presence of bronchitis in months when the meteorological condition named at the head of the column was **greater** than the average for the year: and **less** in months when the same condition was **less** than the average. See proposition 1, relating to bronchitis, page 118.

b An exception to the proposition that **more** than the average per cent of weekly reports stated presence of bronchitis in months when the meteorological condition named at the head of the column was **less** than the average for the year; and **less** in months when the same condition was **greater** than the average for the year. See proposition 2, relating to bronchitis, pages 118–119.

c There is, for 1885, no exception to proposition 2, relating to bronchitis.

* How many stations, and what stations, are represented in the statements for each meteorological subject may be seen by referring to Exhibit VIII., page 116, in which the stations are named, and a statement for the year 1885, in relation to each meteorological subject, is given for each station included in the average for that subject. In Exhibit VIII. is also stated what time the tri-daily observations were made at each station. Additional statements relative to meteorological conditions may be found in an article on the Principal Meteorological conditions in Michigan in 1885, on pages 1–81 of this Report.

† Explanations of statements in these columns, and other statements relative to the prevalence, in 1885, of the diseases under consideration, may be found in Tables 2, pp. 100-101, and 4, page 110, of this Report, and also in Diagrams 1, (p. 89), 2, 3, 4, and 5, on following pages. When the per cent of reports stated for any disease is the same for two months, or for any month is the same as the average, the order of months in the first column of these exhibits has been determined by reference to fractional per cents.

‡ Small numbers in this column indicate great prevalence in the localities where the disease occurred, as compared with other diseases; and large numbers a less prevalence.

§ Calculated from readings of dry bulb and wet bulb thermometers.

‖ Calculated for 18 respirations per minute, of 20 cubic inches of air each. (The numbers in this column are just five-eighths of those in the ne t preceding column.)

¶ Assuming the air exhaled to be saturated with vapor at the temperature of 98° F., in which case each cubic foot of air contains 18.69 grains of vapor, and 18 respirations per minute, of 20 cubic inches of air each, make 11.68 Troy ounces of vapor exhaled daily. No correction has been made for expansion of air after it is inhaled.

** The daily range from which numbers in this column were computed is the difference between the highest and the lowest of the four observations taken during the 24 hours, namely, at 7 A. M., 2 P. M., 9 P. M., of one day, and 7 A. M. of the following day, or at U. S. Signal Service Stations at 7 A. M., 3 P. M., 11 P. M., and 7 A. M., seventy-fifth meridian time, as stated in the * foot-note on page 116.

Proposition 3 also holds true in relation to pneumonia, membranous croup, diphtheria, tonsilitis, influenza, scarlet fever, rheumatism, neuralgia, and pulmonary consumption, treated in Exhibits XII, XIV, XV, XVI, and XVII, on following pages.

What per cent of weekly reports received in 1885 stated presence of bronchitis is graphically represented by months in Diagram 1, page 89.

The evidence of Exhibit X confirms that of similar exhibits relating to bronchitis in previous years.

What per cent of the reports received stated presence of bronchitis by months in each of the years 1877–85; also the average for those years, and a comparison of 1885 with that average, are shown in Exhibit XI above.

RELATIONS OF PNEUMONIA AND OTHER "COLD WEATHER" DISEASES TO METEOROLOGICAL CONDITIONS.

PROPOSITION 1.—That in months when **more** than the average per cent of weekly reports stated the presence of pneumonia (or of membranous croup, diphtheria, tronsilitis, influenza, scarlet fever, rheumatism, neuralgia, or pulmonary consumption), the average daily range of temperature, the relative humidity of the atmosphere, the average per cent of cloudiness, the ozone, the average velocity of the wind, the monthly and the average daily range of the barometer, and the average daily pressure of the atmosphere, were **greater** than the average for the year; and in months when **less** than the average per cent of the reports stated the presence of pneumonia (or of the other diseases named), these conditions were **less** than the average for the year. In Exhibits XII–XVII, on page 123 and the following pages, the letter *a* marks exceptions to this proposition for the year 1885.

PROPOSITION 2.—That in months when **more** than the average per cent of weekly reports stated the presence of pneumonia (or of membranous croup, diphtheria, tonsilitis, influenza, scarlet fever, rheumatism, neuralgia, or pulmonary consumption), the average daily temperature and the absolute humidity of the atmosphere were **less** than the average for the year; and in months when **less** than the average per cent of reports stated the presence of pneumonia (or of the other diseases named), these conditions were **greater** than the average for the year. In Exhibits XII–XVII, on page 123 and following pages, the letter *b* marks exceptions to this proposition for the year 1885.

What per cent of the weekly reports received in 1885 stated presence of pneumonia is graphically represented by months in Diagram 1, page 89. What per cent of the weekly reports received stated presence of pneumonia, and of other diseases mentioned in the two preceding paragraphs, by months in the years 1877–85, is stated in Exhibit XIII, page 122, where are also given an average for those years and a comparison of 1885 with that average.

Comparing Exhibit XIII, page 122, relating to sickness from tonsilitis and neuralgia in the eight years 1877–85 with Exhibit IX, page 117, relating to temperature for the same years, it may be noted that there is a general correspondence (inversely) between the lines stating variations in 1885 from the average temperature for those years, and from the average sickness reported from tonsilitis and neuralgia.

By Exhibit XIII it may be seen that sickness reported from pneumonia was less in 1885 than the average for the nine years 1877–85, and also less in each of the months of 1885 than for the corresponding months of the nine years 1877–85. It will be borne in mind that the average temperature for

1885 was lower, except in July, November, and December, than the average for the nine years 1877–85. The absolute humidity for 1885 was less than the average for the nine years 1877–85, both for the year and for each month, except November. The average daily range of temperature for 1885 was greater for the year and for each month of the year, except April, May, August, October, November, and December, than for the nine years 1877–85.

Neuralgia showed an increase for the year and for each month of the year 1885, except in October and November, over the average of the nine years 1877–85.

EXHIBIT XIII.—*By Year and Months for 1885 and an Average for the Nine Years 1877–85,* Stating on what Per Cent of the Weekly Reports received* PNEUMONIA, MEMBRANOUS CROUP, DIPHTHERIA, RHEUMATISM, INFLUENZA, SCARLET FEVER, TONSILITIS,* AND NEURALGIA* *were Reported Present, and Comparing the Per Cents for Months in 1885 with the Averages for Corresponding Months in those years.*†

	Year and Months.	Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.		Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Pneumonia.	Av. 9 years, 1877–85	38	60	65	62	55	40	26	17	14	17	23	35	46	Membranous Croup.	7	12	10	8	7	5	4	2	2	4	5	9	10
	1884	29	54	49	43	39	24	18	16	11	10	21	29	34		6	7	10	5	4	5	4	4	4	5	7	10	10
	1885	27	50	58	60	50	31	19	11	10	12	17	22	31		5	16	10	10	6	3	3	2	1	3	3	5	5
	In 1885 **Greater** than Av. 1877–85	..	..	..	..	..	..	..	..	..	..	..	..	..		..	4	=	2	..	..	..	=	..	..	..	..	..
	In 1885 **Less** than Av. 1877–85	11	10	7	2	5	9	7	6	4	5	6	13	15		2	..	..	..	1	2	1	..	1	1	2	4	5
Diphtheria.	Av. 9 years, 1877–85	23	29	25	22	21	18	16	15	16	19	27	30	29	Rheumatism.	68	73	73	74	75	71	67	61	57	60	66	72	74
	1884	15	17	13	16	12	17	13	8	14	10	18	19	20		70	65	67	70	75	77	73	67	68	67	67	71	76
	1885	14	14	10	11	16	9	12	14	13	15	19	16	17		68	73	76	82	79	74	71	63	59	60	64	70	70
	In 1885 **Greater** than Av. 1877–85	..	..	..	..	..	..	..	..	..	..	..	..	..		=	=	3	8	4	3	4	2	2	=	..	..	..
	In 1885 **Less** than Av. 1877–85	9	15	14	11	5	9	4	1	3	4	8	14	12		..	..	..	..	..	..	..	..	..	..	2	2	4
Influenza.	Av. 9 years, 1877–85	41	57	62	59	52	39	28	21	22	29	33	42	49	Scarlatina.	19	24	25	25	23	20	17	14	12	13	16	18	19
	1884	41	55	51	50	49	42	30	27	30	34	37	42	49		16	19	25	28	22	25	14	12	12	9	9	10	15
	1885	34	58	60	52	41	31	23	18	18	30	31	37	40		12	16	18	14	13	13	15	13	8	7	13	11	11
	In 1885 **Greater** than Av. 1877–85	..	1	..	..	..	..	..	..	..	1	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
	In 1885 **Less** than Av. 1877–85	7	..	2	7	11	8	5	3	4	..	2	5	9		7	8	7	9	10	7	2	1	4	6	3	7	8
Tonsilitis.	Av. 7 years, 1879–85	49	60	61	60	53	47	42	33	32	37	45	56	60	Neuralgia.	66	69	71	73	73	67	65	60	57	59	63	68	70
	1884	50	53	59	53	53	52	45	38	38	39	48	59	57		70	69	73	74	76	74	67	68	64	63	68	74	73
	1885	50	63	58	61	53	50	43	38	37	42	48	58	60		68	79	79	77	75	67	67	61	58	64	62	67	73
	In 1885 **Greater** than Av. 1879–85	1	3	..	1	=	3	1	5	5	5	3	2	=		2	10	8	4	2	=	2	1	1	5	..	..	3
	In 1885 **Less** than Av. 1879–85	..	..	3	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	1	1	..

* The average line for tonsilitis and neuralgia includes only the seven years, 1879–85.

† Other statements for 1885 and months in 1885 relative to these diseases are given in Table 2, pages 100–109, and in Exhibits XII, XIV, XV, and XVI, pages 123, 125, 126, and 127, where are also given for convenient comparison statements of coincident meteorological conditions. The lines for 1885 are graphically represented in Diagrams 1, page 89, 2, page 124, and 4 on a following page.

EXHIBIT XII.—PNEUMONIA AND MEMBRANOUS CROUP.—*Stating for the Year and for each Month of the Year 1885, what Per Cent of the Weekly Reports of Diseases stated Presence of Pneumonia, also of Membranous Croup, and what were the Meteorological Conditions as Observed at Stations in Michigan.**

	Months in Order of Greatest Per Cent of Weekly Reports Stating Presence of.	PNEUMONIA. Per Cent of Weekly Reports Stating Presence of.†	Average Order of Prevalence where Present.†, ‡	Temperature, F. Av. Daily Range by Registering Thermometer.	Average of Three Daily Observations.	Humidity of Air.§ Av. of 3 Daily Observations. Relative, Per Cent of Saturation.	Absolute,—Grains of Vapor in a Cubic Foot of Air.	Vapor Inhaled and Exhal'd (Tr'y oz.) from Air Passages, by one Person in 24 Hours. Inhaled.‖	Exhaled in Excess of that Inhaled.¶	Average Per Cent of Cloudiness.	Ozone,—Relative, Scale of 10°. Day Observation, 7 A. M. to 2 P. M.	Night Observation, 9 P. M. to 7 A. M.	Average Velocity of Wind, Miles Per Hour, by Anemometer.	Atmospheric Pressure. Inches. Reduced to 32° Fahr. Range. Monthly, and for Year.	Average Daily, by Three Daily Observations.**	Average Pressure.
More than Av. Per Ct. of Pneumonia.	Mar...	60	4.0	22.22	19.51	77	1.25	.78	10.90	a51	3.31	3.75	10.2	1.068	.267	29.197
	Feb...	58	3.4	22.94	10.21	80	.94	.59	11.09	a57	3.05	3.65	a9.0	1.160	.217	a29.130
	April.	50	4.1	a18.25	41.39	a72	2.53	1.58	10.10	58	3.21	3.96	10.4	.930	.253	29.207
	Jan...	50	4.4	a17.03	15.46	80	1.14	.71	9.97	67	a2.88	a3.49	11.8	1.356	.319	29.211
	Dec...	31	4.0	a13.19	27.59	82	1.72	1.08	10.60	81	a2.92	3.50	11.6	1.317	.314	a29.148
	May...	31	4.2	19.72	b53.32	a69	b3.62	2.26	9.42	a50	2.96	3.68	a9.0	a.709	a.148	a29.105
Average......		27	4.4	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.49	9.4	.906	.209	29.164
Less than Av. Per Ct. of Pneumonia.	Nov...	22	4.9	11.53	b38.14	a82	b2.50	1.56	10.12	a84	2.87	3.38	a9.9	.800	.181	29.105
	June..	19	5.1	a22.73	63.39	70	4.90	3.06	8.62	41	2.61	3.20	8.7	.655	.165	a29.195
	Oct...	17	4.5	16.81	45.78	a79	3.17	1.98	9.70	a59	a3.03	3.43	8.2	.809	.182	29.161
	Sept...	12	5.1	a20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	.737	.173	a29.209
	July..	11	5.0	a22.09	71.13	71	6.12	3.83	7.85	41	2.47	3.00	7.6	.525	.118	29.150
	Aug...	10	5.1	18.45	63.23	a78	5.29	3.31	8.37	54	a3.07	3.41	8.1	.808	.165	a29.165
MEMBRANOUS CROUP.																
More than Av. Per Ct. of Mem. Croup.	Jan...	16	5.5	a17.03	15.46	80	1.14	.71	9.97	67	a2.88	3.49	11.8	1.356	.319	29.211
	Feb...	10	6.0	22.94	10.21	80	.94	.59	11.09	a57	3.05	3.65	a9.0	1.160	.217	a29.130
	Mar...	10	5.4	22.22	19.51	77	1.25	.78	10.90	a51	3.31	3.75	10.2	1.068	.267	29.197
	Apr...	6	6.4	a18.25	41.39	a72	2.53	1.58	10.10	58	3.21	3.96	10.4	.930	.253	29.207
	Dec...	5	5.3	a13.19	27.59	82	1.72	1.08	10.60	81	a2.92	3.50	11.6	1.317	.314	a29.148
Average		5	6.1	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.47	9.4	c.906	c.209	29.164
Less than Av. Per Cent of Membranous Croup.	Nov...	5	5.9	11.53	b38.14	a82	b2.50	1.56	10.12	a84	2.87	3.38	a9.9	.800	.181	29.105
	Oct...	3	5.9	16.81	45.78	a79	3.17	1.98	9.70	a59	a3.03	3.43	8.2	.809	.182	29.161
	June.	3	6.3	a22.73	63.39	70	4.90	3.06	8.62	41	2.61	3.20	8.7	.655	.165	a29.195
	Sept...	3	6.7	a20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	.737	.173	a29.209
	May...	3	7.0	a19.72	53.32	69	3.62	2.26	9.42	50	a2.96	a3.68	9.0	.709	.148	29.105
	July...	2	7.6	a22.09	71.13	71	6.12	3.83	7.85	41	2.47	3.00	7.6	.525	.118	29.150
	Aug...	1	10.7	18.45	63.23	a78	5.29	3.31	8.37	54	a3.07	3.41	8.1	.808	.165	a29.165

*, †, ‡, §, ‖, ¶, **. See foot-notes with these marks in Exhibit X, page 120.
a Exceptions to Proposition 1, relating to Pneumonia and Membranous Croup, on page 121.
b Exceptions to Proposition 2, relating to Pneumonia and Membranous Croup, on page 121.

DIAGRAM 2—WEEKLY REPORTS OF DISEASES IN MICHIGAN, IN 1885.

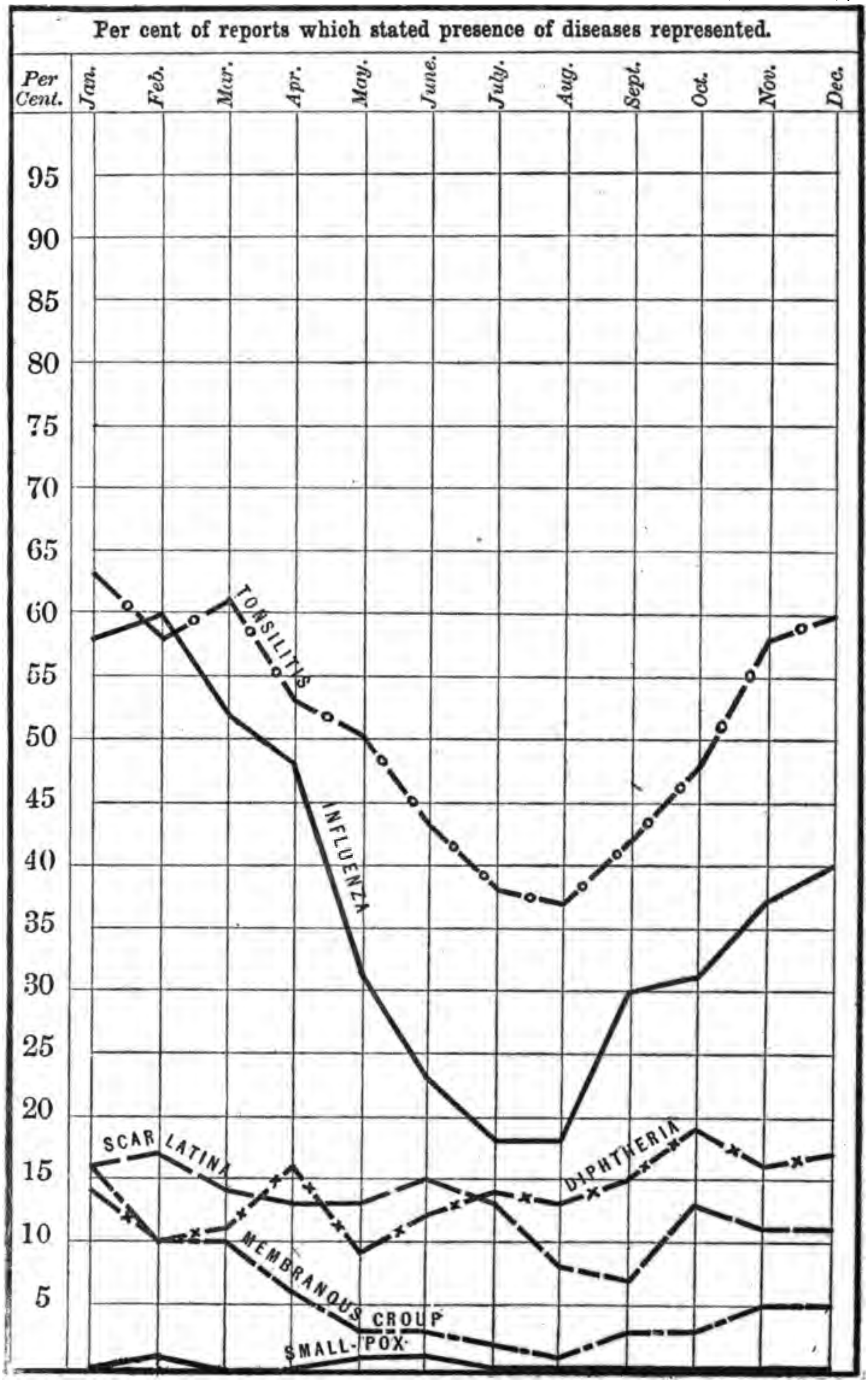


EXHIBIT XIV.—DIPHTHERIA AND TONSILITIS.—*Stating for the Year and for each Month of the Year 1885, what Per Cent of the Weekly Reports of Diseases Stated Presence of Diphtheria, also of Tonsilitis, and what were the Meteorological Conditions, as observed at Stations in Michigan.* *

DIPHTHERIA. Months in Order of Greatest Per Cent of Weekly Reports Stating Presence of.		Per Cent of Weekly Reports Stating Presence of.†	Av. Order of Prevalence where Present. †, ‡.	Temperature, F. Av. Daily Range, by Registering Thermometers.	Temperature, F. Av. of Three Daily Observations.	Humidity of Air. § Av. of 3 Daily Observations. Relative Per Cent of Saturation.	Humidity of Air. Absolute,—Grs. of Vapor in a Cu. Ft. of Air.	Vapor Inhaled and Exhaled, from Air Passages, by 1 Person in 24 Hours. Troy Ozs. Inhaled. ‖	Vapor Exhaled, in Excess of that Inhaled. ¶	Av. Per Cent of Cloudiness.	Ozone,—Relative Scale of 10.° Day Observation, 7 A. M. to 2 P. M.	Ozone. Night Observation, 9 P. M. to 7 A. M.	Av. Velocity of Wind, Miles per Hour, by Anemometer.	Atmospheric Pressure. Inches. Reduced to 32° F. Range. Monthly, and for Year.	Range. Av. Daily, by 3 Daily Observations.**	Average Pressure.
More than Av. Per Ct. of Diphtheria.	Oct.....	19	4.3	a 16.81	b 45.78	79	b 3.17	1.98	9.70	59	3.03	a 3.43	a 8.2	a .809	a .182	a 29.161
	Dec.....	17	4.1	a 13.19	27.59	82	1.72	1.08	10.60	81	a 2.92	3.50	11.6	1.317	.314	a 29.148
	Nov.....	16	4.4	a 11.53	38.14	82	2.50	1.56	10.12	84	a 2.87	a 3.38	9.9	a .800	a .181	a 29.105
	April..	16	5.9	a 18.25	41.39	a 72	2.53	1.58	10.10	58	3.21	3.96	10.4	.930	.253	29.207
	Sept....	15	4.5	20.42	b 59.14	a 75	b 4.56	2.85	8.83	a 44	a 2.72	a 3.14	a 8.8	a .737	a .173	29.209
Average.....		14	4.7	18.78	42.[illegible]6	76	3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Av. Per Ct. of Diphtheria.	Jan.....	14	5.4	17.03	b 15.46	a 80	b 1.14	.71	9.97	a 67	2.88	a 3.49	a 11.8	a1.356	a .319	a29.211
	July....	14	4.8	a 22.09	71.13	71	6.12	3.83	7.85	41	2.47	3.00	7.6	.525	.118	29.150
	Aug.....	13	5.2	18.45	63.23	a 78	5.29	3.31	8.37	54	a 3.07	3.41	8.1	.808	.165	a 29.165
	June ..	12	4.5	a 22.73	63.39	70	b 4.90	3.06	.62	41	2 61	3.20	8.7	.655	.165	a 29.195
	Mar.....	11	6.6	a 22.22	b 19.51	a 77	b 1.25	.78	10.90	51	3.31	a 3.75	a 10.2	a1.068	a .267	a 29.197
	Feb.....	10	4.9	a 22.94	b10.21	a 80	b .94	.59	11.09	a 57	a 3.05	a 3.65	9.0	a1.160	a .217	29.130
	May....	9	4.7	a 19.72	53.32	69	3.62	2.26	9.42	50	a 2 96	a 3.68	9.0	.709	.148	29.105
TONSILITIS.																
More than Av. Per Cent of Tonsilitis.	Jan.....	63	3.2	a 17.03	15.46	80	1.14	.71	9.97	67	a 2.88	3.49	11.8	1.356	.319	29.211
	Mar.....	61	3.5	22.22	19.51	77	1.25	.78	10.90	a 51	3.31	3.75	10.2	1.068	.267	29.197
	Dec.....	60	3.1	a 13.19	27.59	82	1.72	1.08	10.60	81	a 2.92	3.50	11.6	1.317	.314	a 29.148
	Feb.....	58	3.5	22.94	10.21	80	.94	.59	11.09	a 57	3.05	3.65	a 9.0	1.160	.217	a 29.130
	Nov.....	58	3.3	a 11.53	38.14	82	2.50	1.56	10.12	84	a 2.87	a 3.38	9.9	a .800	a .181	a 29.105
	April..	53	3.6	a 18.25	41.39	a 72	2.53	1.58	10.10	58	3.21	3.96	10.4	.930	.253	29.207
	May	50	3.4	19.72	b 53.32	a 69	b 3.62	2.26	9.42	a 50	2.96	3.68	a 9.0	a .709	a .148	a 29.105
Average		50	3.5	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Av. Per Ct. of Tonsilitis.	Oct.....	48	3.4	16.81	45.78	a 79	3.17	1.98	9.70	a 59	a 3.03	3.43	8.2	.809	.182	29.161
	June ..	43	3.6	a 22.73	63.39	70	4.90	3.06	8.62	41	2.61	3.20	8.7	.655	.165	a 29.195
	Sept....	42	3.7	a 20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	.737	.173	a 29.209
	July....	38	3.4	a 22.09	71.13	71	6.12	3.83	7.85	41	2.47	3.00	7.6	.525	.118	29.150
	Aug.....	37	4.0	18.45	63.23	a 78	5.29	3.31	8.37	54	a 3.07	3.41	8.1	.808	.165	a 29.165

*, †, ‡, §, ‖, ¶, ** See footnotes with these marks in Exhibit X, page 120. *a* Exceptions to Proposition 1, relating to diphtheria and tonsilitis, on page 121. *b* Exceptions to proposition 2, relating to diphtheria and tonsilitis, on page 121.

EXHIBIT XV. INFLUENZA AND SCARLET FEVER.—*Stating for the Year and for each Month of the Year 1885, what Per Cent. of the Weekly Reports of Diseases Stated Presence of Influenza; also of Scarlet Fever, and what were the Meteorological Conditions, as Observed at Stations in Michigan.**

	INFLUENZA. Months in Order of Greatest Per Cent. of Weekly Reports Stating Presence of.	Per Cent of Weekly Reports Stating Presence of.†	Average Order of Prevalence where Present.†, ‡	Temperature, F. Av. Daily Range, by Registering Thermometers.	Temperature, F. Average of Three Daily Observations.	Humidity of Air§ Av. of 3 Daily Observations. Relative Per Ct. of Saturation.	Humidity of Air§ Av. of 3 Daily Observations. Absolute,—Grs. of Vapor in a Cubic Foot of Air.	Vapor Inhaled and Exhaled from Air Passages, by one Person in 24 Hours. Troy Ozs. Inhaled.‖	Vapor Inhaled and Exhaled from Air Passages, by one Person in 24 Hours. Troy Ozs. Exhaled, in Excess of that Inhaled.¶	Average Per Cent of Cloudiness.	Ozone,—Relative Scale of 10°. Day Observation, 7 A. M. to 2 P. M.	Ozone,—Relative Scale of 10°. Night Observation, 9 P. M. to 7 A. M.	Average Velocity of Wind, Miles Per Hour, by Anemometer.	Atmospheric Pressure. Inches. Reduced to 32° F. Range. Monthly, and for Year.	Atmospheric Pressure. Inches. Reduced to 32° F. Range. Av. Daily, by 3 Daily Observations.**	Atmospheric Pressure. Inches. Reduced to 32° F. Average Pressure.
More than Av. Per Cent of Influenza.	Feb.	60	2.6	22.94	10.21	80	.94	.59	11.09	a 57	3.05	3.65	a 9.0	1.160	.217	a29.130
	Jan.	58	2.3	a17.03	15.46	80	1.14	.71	9.97	67	a2.88	3.49	11.8	1.356	.319	29.211
	March	52	2.3	22.22	19.51	77	1.25	.78	10.90	a 51	3.31	3.75	10.2	1.068	.267	29.197
	April	41	2.5	a18.25	41.39	a 72	2.53	1.58	10.10	58	3.21	3.96	10.4	.930	.253	29.207
	Dec.	40	2.5	a13.19	27.59	82	1.72	1.08	10.60	81	a2.92	3.50	11.6	1.317	.314	a29.148
	Nov.	37	2.6	a11.53	38.14	82	2.50	1.56	10.12	84	a2.87	a3.38	9.9	a.800	a.181	a29.105
Average		34	2.9	18.78	c42.36	76	c3.14	1.96	9.72	57	2.[illegible]2	3.47	9.4	.906	.209	29.164
Less than Av. Per Ct. of Influenza.	Oct.	31	2.7	16.81	45.78	a 79	3.17	1.98	9.70	a 59	a3.03	3.43	8.2	.809	.182	29.161
	May	31	3.0	a19.72	53.32	69	3.62	2.26	9.42	50	a2.96	a3.68	9.0	.709	.148	29.105
	Sept.	30	3.4	a20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	.737	.173	a29.209
	June	23	3.2	a22.73	63.39	70	4.90	3.06	8.62	41	2.61	3.20	8.7	.655	.165	a29.195
	July	18	3.7	a22.09	71.13	71	6.12	3.83	7.85	41	2.47	3.00	7.6	.525	.118	29.150
	August	18	4.1	18.45	63.23	a 78	5.29	3.31	8.37	54	a3.07	3.41	8.1	.808	.165	a29.165
SCARLET FEVER.																
More than Av. Per Ct. of Scarlatina.	Feb.	18	6.2	22.94	10.21	80	.94	.59	11.09	a 57	3.05	3.65	a 9.0	1.160	.217	a29.130
	Jan.	16	6.2	a17.03	15.46	80	1.14	.71	9.97	67	a2.88	3.49	11.8	1.356	.319	29.211
	June	15	4.7	22.73	b63.39	a 70	b4.90	3.06	8.62	a 41	a2.61	a3.20	a 8.7	a.655	a.165	29.195
	March	14	7.4	22.22	19.51	77	1.25	.78	10.90	a 51	3.31	3.75	10.2	1.068	.267	29.197
	April	13	5.9	a18.25	41.39	a 72	2.53	1.58	10.10	58	3.21	3.96	10.4	.930	.253	29.207
	May	13	4.8	19.72	b53.32	a 69	b3.62	2.26	9.42	a 50	2.96	3.68	a 9.0	a.709	a.148	a29.105
	July	13	4.0	22.09	b71.13	a 71	b6.1[illegible]	3.83	7.85	a 41	a2.47	a3.00	a 7.6	a.525	a.118	a29.150
	Oct.	13	4.1	a16.81	b45.78	79	b3.17	1.98	9.70	59	3.03	a3.43	a 8.2	a.809	a.182	a29.161
Average		12	5.0	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Av. Per Cent of Scarlatina.	Nov.	11	4.5	11.53	b38.14	a 82	b2.50	1.56	10.12	a 84	2.87	3.38	a 9.9	.800	.181	29.105
	Dec.	11	4.2	13.19	27.59	a 82	b1.72	1.08	10.60	a 81	a2.92	a3.50	a11.6	a1.317	a.314	29.148
	Aug.	8	4.8	18.45	b63.23	a 78	5.29	3.31	8.37	54	a3.07	3.41	8.1	.808	.165	a29.165
	Sept.	7	5.1	a20.42	b59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	.737	.173	a29.209

*, †, ‡, §, ‖, ¶, **. See foot-notes with these marks in Exhibit X, page 120.
a Exceptions to Proposition 1, relating to influenza and scarlet fever, on page 121.
b Exceptions to Proposition 2, relating to influenza and scarlet fever, on page 121.

EXHIBIT XVI.—RHEUMATISM AND NEURALGIA.—*Stating for the Year and for each Month of the Year 1885, what Per Cent of the Weekly Reports of Diseases Stated Presence of Rheumatism, also of Neuralgia, and what were the Meteorological Conditions, as Observed at Stations in Michigan.**

	Months in Order of Greatest Per Cent of Weekly Reports Stating Presence of.	RHEUMATISM. Per Cent of Weekly Reports Stating Presence of.†	RHEUMATISM. Average Order of Prevalence where Present.†‡	Temperature, F. Average Daily Range by Registering Thermometers.	Temperature, F. Average of three Daily Observations.	Humidity of Air.§ Av. of 3 Daily Observations. Relative Per Cent of Saturation.	Humidity of Air.§ Absolute—Grains of Vapor in a Cubic Foot of Air.	Vapor Inhaled and Exhaled from Air Passages, by one person in 24 hours, Troy Ozs. Inhaled.‖	Vapor ... Exhaled in excess of that Inhaled.¶	Average Per Cent of Cloudiness.	Ozone.—Relative Scale of 10°. Day Observation, 7 A. M. to 2 P. M.	Ozone. Night Observation, 9 P. M. to 7 A. M.	Average Velocity of Wind, Miles per hour, by Anemometer.	Atmospheric Pressure, Inches, Reduced to 32° F. Range. Monthly and for year.	Range. Average Daily, by three Daily Observations.**	Average Pressure.
More than Av. Per Cent of Rheumatism.	March	82	3.6	22.22	19.51	77	1.25	.78	10.90	a51	3.31	3.75	10.2	1.068	.267	29.197
	April	79	3.3	a18.25	41.39	a72	2.53	1.58	10.10	58	3.21	3.93	10.4	.930	.253	29.207
	February	76	3.5	22.94	10.21	80	.94	.59	11.09	a57	3.05	3.65	a9.0	1.160	.217	a29.130
	May	74	2.8	19.72	b53.32	a69	b3.62	2.26	9.42	a50	2.96	3.68	a9.0	a.709	a.148	a29.105
	January	73	3.4	a17.03	15.46	80	1.14	.71	9.97	67	a2.88	3.49	11.8	1.356	.319	29.211
	June	71	3.0	22.73	b63.39	a70	b4.90	3.06	8.62	a41	a2.61	a3.20	a8.7	a.655	a.165	29.195
	November	70	2.9	a11.53	38.14	82	2.50	1.56	10.12	84	a2.87	a3.38	9.9	a.800	a.181	a29.105
	December	70	2.8	a13.19	27.59	82	1.72	1.08	10.60	81	a2.92	3.50	11.6	1.317	.314	a29.148
Average		68	3.2	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Av. Per Cent of Rheumatism.	October	64	3.0	16.81	45.78	a79	3.17	1.98	9.70	a59	a3.03	3.43	8.2	.809	.182	29.161
	July	63	3.3	a22.09	71.13	71	6.12	3.83	7.85	41	2.47	3.00	7.6	.525	.118	29.150
	September	60	3.4	a20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	.737	.173	a29.209
	August	59	3.7	18.45	63.23	a78	5.29	3.31	8.37	54	a3.07	3.41	8.1	.808	.165	a29.165
NEURALGIA.																
More than Av. Per Cent of Neuralgia.	January	79	2.8	a17.03	15.46	80	1.14	.71	9.97	67	a2.88	3.49	11.8	1.356	.319	29.211
	February	79	3.1	22.94	10.21	80	.94	.59	11.09	a57	3.05	3.65	a9.0	1.160	.217	a29.130
	March	77	3.0	22.22	19.51	77	1.25	.78	10.90	a51	3.31	3.75	10.2	1.068	.267	29.197
	April	75	2.7	a18.25	41.39	a72	2.53	1.58	10.10	58	3.21	3.96	10.4	.930	.253	29.207
	December	73	2.4	a13.19	27.59	82	1.72	1.08	10.60	81	a2.92	3.50	11.6	1.317	.314	a29.148
Average		68	2.8	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.47	9.4	c.906	c.209	29.164
Less than Av. Per Cent of Neuralgia.	May	67	2.8	a19.72	53.32	69	3.62	2.26	9.42	50	a2.96	a3.68	9.0	.709	.148	29.105
	November	67	2.5	11.53	b38.14	a82	b2.50	1.56	10.12	a84	2.87	3.38	a9.9	.800	.181	29.105
	June	67	2.6	a22.73	63.39	70	4.90	3.06	8.62	41	2.61	3.20	8.7	.655	.165	a29.195
	September	64	2.9	a20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	.737	.172	a29.209
	October	62	2.8	16.81	45.78	a79	3.17	1.98	9.70	a59	a3.03	3.43	8.2	.809	.182	29.161
	July	61	2.8	a22.09	71.13	71	6.12	3.83	7.85	41	2.47	3.00	7.6	.525	.118	29.150
	August	58	3.2	18.45	63.23	a78	5.29	3.31	8.37	54	a3.07	3.41	8.1	.808	.165	a29.165

***, †, ‡, §, ‖, ¶, **. See foot-notes with these marks in Exhibit X, page 120.**
a. Exceptions to Proposition 1, relating to Rheumatism and Neuralgia, on page 121.
b. Exceptions to Proposition 2, relating to Rheumatism and Neuralgia, on page 121.
c There is for 1885 no exception to Proposition 1, relating to neuralgia as regards range of barometer.

DIAGRAM 4.—WEEKLY REPORTS OF DISEASES IN MICHIGAN, IN 1885.

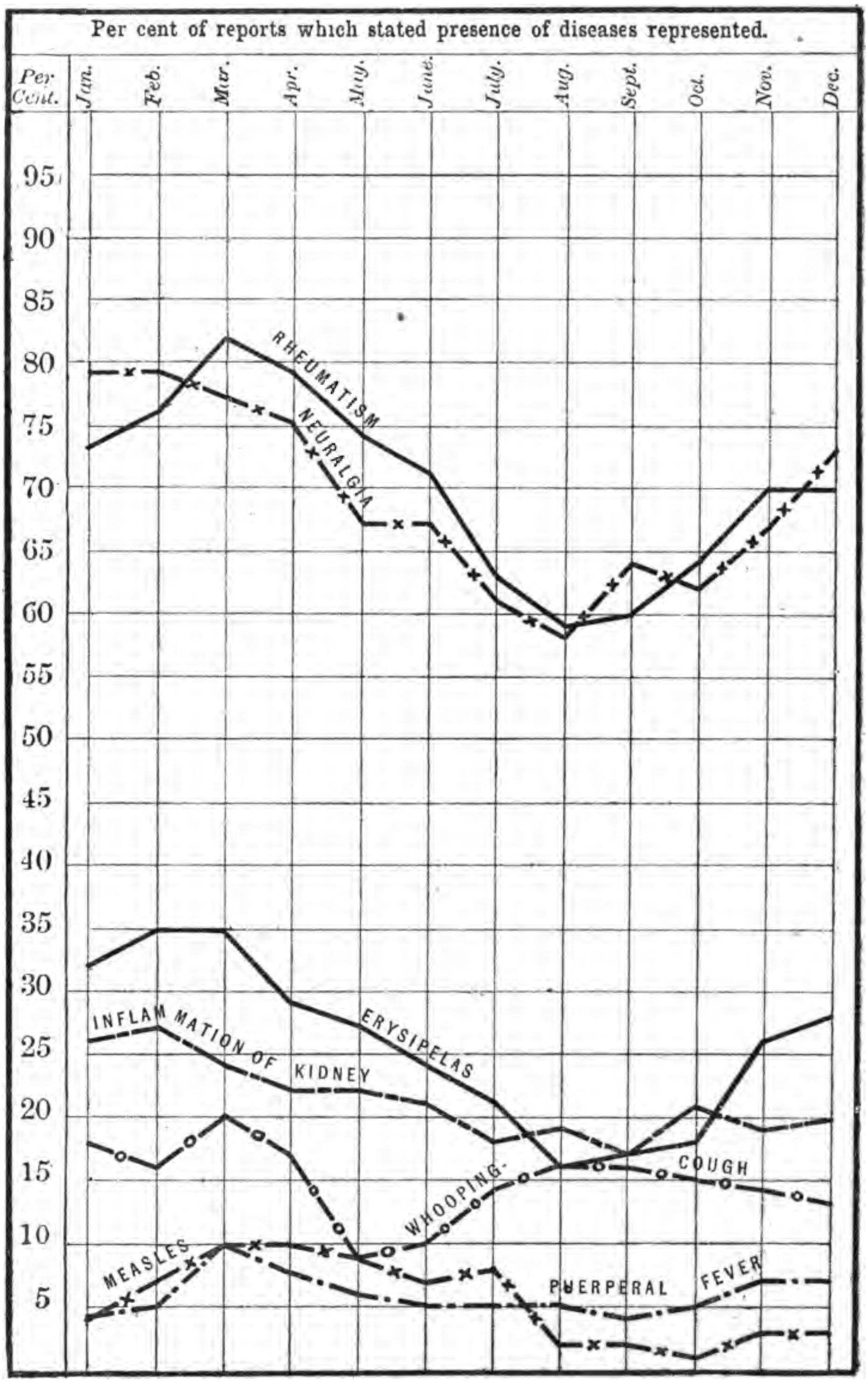


EXHIBIT XVII.—PULMONARY CONSUMPTION.—*Stating for the Year and for each Month of the Year 1885, what Per Cent. of the Weekly Reports of Diseases stated presence of Consumption, and what were the Meteorological Conditions, as Observed at Stations in Michigan.**

Consumption. Months in Order of Greatest Per Cent. of Weekly Reports Stating Presence of.		Consumption. Per Cent. of Weekly Reports Stating Presence of.†	Consumption. Av. Order of Prevalence where Present.†‡	Temperature, F. Av. Daily Range, by Registering Thermometers.	Temperature, F. Av. of Three Daily Observations.	Humidity of Air.§ Av. of Three Daily Observat'ns. Relative Per Cent. of Saturation.	Humidity of Air.§ Av. of Three Daily Observat'ns. Absolute—Grains of Vapor in a Cubic Foot of Air.	Vapor Inhaled and Exhaled from Air Passages, by one Person in 24 Hours, Troy Ounces. Inhaled.‖	Vapor Inhaled and Exhaled from Air Passages, by one Person in 24 Hours, Troy Ounces. Exhaled in Excess of that Inhaled.¶	Av. Per Cent. of Cloudiness.	Ozone,—Relative Scale of 10.° Day Observation, 7 A. M. to 2 P. M.	Ozone,—Relative Scale of 10.° Night Observation, 9 P. M. to 7 A. M.	Av. Velocity of Wind, Miles per Hour, by Anemometer.	Atmospheric Pressure. Inches. Reduced to 32 ° F. Range. Monthly and for Year.	Atmospheric Pressure. Inches. Reduced to 32 ° F. Range. Av. Daily, by Three Daily Observa'ns.**	Atmospheric Pressure. Inches. Reduced to 32 ° F. Average Pressure.
More than Av. Per Ct. of Consumpt'n.	Mar..	71	4.6	22.22	19.51	77	1.25	.78	10.90	a 51	3.31	3.75	10.2	1.068	.267	29.197
	April	69	4.2	a18.25	41.39	a 72	2.53	1.58	10.10	58	3.21	3.96	10.4	.930	.253	29.207
	Feb..	68	4.9	22.94	10.21	80	.94	.59	11.09	a 57	3.05	3.65	a 9.0	1.160	.217	a29.130
	June.	61	3.6	22.73	b63.39	a 70	b 4.90	3.06	8.62	a 41	a 2.61	a 3.20	a 8.7	.655	a .165	29.195
	Jan..	60	4.7	a17.03	15.46	80	1.14	.71	9.97	67	a 2.88	3.49	11.8	1.356	.319	29.211
Average....		58	4.0	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Average Per Cent. of Consumption.	May.	58	3.9	a19.72	53.32	69	3.62	2.26	9.42	50	a 2.96	a 3.68	9.0	.799	.148	29.105
	July.	56	3.8	a22.09	71.13	71	6.12	3.83	7.85	41	2.47	3.00	7.6	.525	.118	29.150
	Dec..	56	3.7	13.19	b27.59	a 82	b 1.72	1.08	10.60	a 81	a 2.92	a 3.50	a 11.6	a1.317	a .314	29.148
	Nov.	56	4.0	11.53	b38.14	a 82	b 2.50	1.56	10.12	a 84	2.87	3.38	a 9.9	.800	.181	29.105
	Oct..	55	3.8	16.81	45.78	a 79	3.17	1.98	9.70	a 59	a 3.03	3.43	8.2	.809	.182	29.161
	Sept.	54	3.8	a20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	.737	.173	a29.209
	Aug..	52	4.1	18.45	63.23	a 78	5.29	3.31	8.37	54	a 3.07	3.41	8.1	.808	.165	a29.165

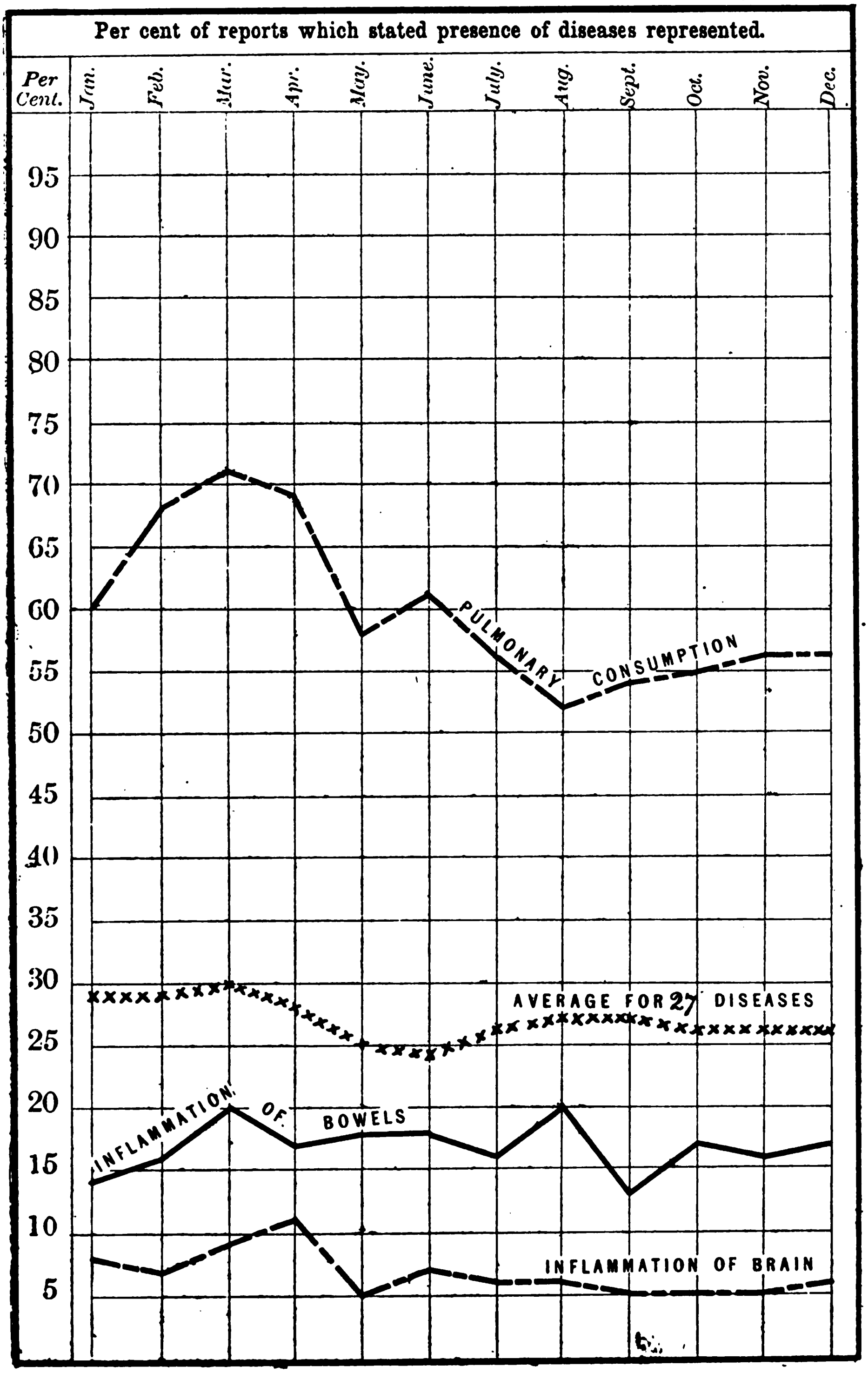
*, †, ‡, §, ‖, ¶, **. See foot-notes with these marks in Exhibit X, page 120.
a. Exceptions to Proposition 1, relating to Consumption, on page 121.
b. Exceptions to Proposition 2, relating to Consumption, on page 121.

EXHIBIT XVIII.—SICKNESS FROM CONSUMPTION, 1877–85.—*By Year and Months for each of the Nine Years 1877–85, Stating on what Per Cent of the Weekly Reports received* CONSUMPTION *was Reported Present, and Comparing the Per Cents for 1885 with the Averages for Corresponding Months in those Years.*

Years, Etc.	Annual Av.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average for 8 Years 1878-85*	66	66	69	70	71	68	66	64	62	64	66	65	64
1877*	52	50	47	47	53	49	50	43	35	38	34	68	65
1878	71	67	72	76	75	72	68	68	65	70	73	73	71
1879	70	71	71	69	77	74	73	69	67	67	69	67	64
1880	68	65	69	70	72	70	69	66	62	66	66	68	70
1881	71	74	76	73	76	69	68	67	67	70	73	74	67
1882	66	66	68	66	66	69	66	67	63	63	65	62	65
1883	61	69	66	66	65	62	61	59	55	57	58	58	60
1884	63	56	61	66	70	67	65	63	63	63	65	61	58
1885	58	60	68	71	69	58	61	56	52	54	55	56	56
In 1885 **Greater** than Av. '78-85.	......	....	....	1	....	....	....	....	....	....	....	....	....
In 1885 **Less** than Av. 1878-85	8	6	1	....	2	10	5	8	10	10	11	9	8

* As consumption was not printed on the first blanks, nor on all used in 1877, that year is excluded from the average line.

DIAGRAM 5.—WEEKLY REPORTS OF DISEASES IN MICHIGAN, IN 1885.



RELATIONS OF DIARRHEA TO METEOROLOGICAL CONDITIONS.

PROPOSITION 1.—That in months when **more** than the average per cent of weekly reports stated the presence of diarrhea, the average daily range of temperature, the average daily temperature, the absolute humidity of the atmosphere, the monthly and the average daily range of the barometer, and the average daily pressure of the atmosphere were **greater** than the average for the year; and in months when **less** than the average per cent of reports stated the presence of diarrhea, these conditions were **less** than the average for the year. In Exhibit XIX, page 134, the letter *a* marks exceptions to this proposition for the year 1885.

Explanations of Propositions 1 and 2 are given on page 118, and a summary of the evidence in Exhibit XIX is given in Exhibit XX, on the following page.

PROPOSITION 2.—That in months when **more** than the average per cent of weekly reports stated the presence of diarrhea, the relative humidity of the atmosphere, the average per cent of cloudiness, the ozone, and the average velocity of the wind were **less** than the average for the year; and in months when **less** than the average per cent of reports stated the presence of diarrhea, these conditions were **greater** than the average for the year. In Exhibit XIX, page 134, the letter *b* marks exceptions to this proposition for 1885.

PROPOSITION 3.—For those months which are not, as regards the absolute humidity of the atmosphere, exceptions to Proposition 1, it is true also that the quantity of vapor inhaled daily was **greater** than the average, and the quantity exhaled daily in excess of that inhaled was **less** than the average in months when **more** than the average per cent of reports stated presence of diarrhea; and that **less** vapor was inhaled and a **greater** excess exhaled daily in months when the per cent of reports stating presence of diarrhea was **less** than the average.

Proposition 3 is true also in relation to cholera infantum, intermittent fever, remittent fever, typhoid fever, typho-malarial fever, measles, and whooping-cough, treated in Exhibits XIX, XXI, XXII, and XXIII, page 134, and following pages.

On what per cent of the weekly reports received, by months, in the nine years, 1877–85, the eight foregoing diseases were reported present is stated in Exhibit XX, page 135. In Diagram 1, page 89, is graphically represented by months what per cent of the reports in each month in 1885 stated the presence of diarrhea.

The greatest sickness reported from diarrhea in 1885 was in August, September and July. For the year 1885 the reports indicated a decreased prevalence of diarrhea when compared with the average for the nine years 1877–85, and also a decreased prevalence for each month of the year 1885, except for the months of February, March and April. In May, 1885, the per cent was the same as the average for the nine years 1877–85. The average temperature for the year was lower than the average for the nine years, except in July, November and December. The average daily range of temperature was greater for the year and for each month in the year except April, May, August, October, November and December, than for the seven years 1879–85. The absolute humidity was more in 1885 and for each month in the year, except in January, June and July, than the average for the nine years 1877–85.

RELATIONS OF CHOLERA INFANTUM AND OTHER "WARM WEATHER" DISEASES TO METEOROLOGICAL CONDITIONS.

PROPOSITION 1.—That in months when **more** than the average per cent of weekly reports stated the presence of cholera infantum (or of intermittent fever, remittent fever, typhoid fever, typho-malarial fever, measles, or whooping-cough), the average daily range of temperature, the average daily temperature, the absolute humidity of the atmosphere, the monthly and the average daily range of the barometer, and the average daily pressure of the atmosphere were **greater** than the average for the year; and in months when **less** than the average per cent of reports stated the presence of cholera infantum (or of the other diseases named), these conditions were **less** than the average for the year. In Exhibit XIX, page 134, the letter *a* marks exceptions to this proposition for the year 1885.

Explanations of propositions 1 and 2 are given on page 118, and a summary of the evidence of Exhibit XIX is given in Exhibit XX, on a following page.

PROPOSITION 2.—That in months when **more** than the average per cent of weekly reports stated the presence of cholera infantum (or of intermittent fever, remittent fever, typhoid fever, typho-malarial fever, measles, or whooping-cough), the relative humidity of the atmosphere, the average per cent of cloudiness, the ozone, and the average velocity of the wind were **less** than the average for the year; and that in months when **less** than the average per cent of reports stated the presence of cholera infantum (or of the other diseases named), these conditions were **greater** than the average for the year. In Exhibit XIX, page 134, the letter *b* marks exceptions to this proposition for 1885.

What per cent of all the weekly reports of sickness in each month in 1885 stated presence of cholera infantum is graphically represented by months in Diagram 1, page 89. What per cent of the reports received, by months in the nine years 1877–85, stated presence of cholera infantum, and of the other diseases mentioned in the two preceding paragraphs, Propositions 1 and 2, is stated in Exhibit XX, page 135.

Cholera infantum was most prevalent during and immediately following the hot months—September, August, July, and October being for 1885 the months from which more than the average sickness from this disease was reported. Compared with the average for the nine years 1877-85, there was a decrease in sickness reported from cholera infantum for the year, and for each month in the year 1885, except in May and January. In April, November and December there was neither increase nor decrease. The comparison of temperatures can be studied in Exhibit IX., page 117; the comparison of reported sickness from cholera infantum in Exhibit XX, page 135.

EXHIBIT XIX.—Diarrhea and Cholera Infantum.—*Stating for the Year and for each Month of the Year 1885, what Per Cent. of the Weekly Reports of Diseases Stated Presence of Diarrhea, also Cholera Infantum, and what were the Meteorological Conditions, as Observed at Stations in Michigan.**

	Diarrhea. Months in Order of Greatest Per Cent. of Weekly Reports Stating Presence of.	Per Cent of Weekly Reports Stating Presence of.†	Average Order of Prevalence where Present. †, ‡	Temperature, F. Average Daily Range, by Registering Thermometers.	Temperature, F. Average of 3 Daily Observations.	Humidity of Air.§ Av. of 3 Daily Observations. Relative Per Cent of Saturation.	Humidity of Air.§ Absolute,—Grains of Vapor in a Cubic Foot of Air.	Vapor Inhaled and Exhaled, from Air-passages, by one person in 24 hours, Troy Ozs. Inhaled. ‖	Vapor Inhaled and Exhaled. Exhaled, in excess of that inhaled.¶	Average Per Cent of Cloudiness.	Ozone,—Relative scale of 10°. Day Observation, 7 A. M. to 2 P. M.	Ozone,—Relative scale of 10°. Night Observation, 9 P. M. to 7 A. M.	Miles. Average Velocity of Wind, Per Hour, by Anemometer.	Atmospheric Pressure. Inches reduced to 32°. F. Range. Monthly, and for Year.	Atmospheric Pressure. Range. Average Daily, by 3 Daily Observations. **	Atmospheric Pressure. Average Pressure.
More than Av. Per Cent of Diarrhea.	August	77	2.2	a18.45	63.23	b78	5.29	3.31	8.37	54	b3.07	3.41	8.1	a.808	a.165	29.165
	Sept	65	2.4	20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	a.739	a.173	29.209
	July	65	2.3	22.09	71.13	71	6.12	3.83	7.85	41	2.47	3.00	7.6	a.525	a.118	a29.150
Average		46	3.3	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Av. Per Cent of Diarrhea.	October	44	3.0	16.81	a45.78	79	a3.17	1.98	9.70	59	3.03	b3.43	b8.2	.809	.182	29.161
	June	44	3.6	a22.73	a63.39	b70	a4.90	3.06	8.62	b41	b2.61	b3.20	b8.7	.655	.165	a29.195
	May	36	3.7	a19.72	a53.32	b69	a3.62	2.26	9.42	b50	2.96	3.68	b9.0	.709	.148	29.105
	March	35	4.9	a22.22	19.51	77	1.25	.78	10.90	b51	3.31	3.75	10.2	a1.068	a.267	a29.197
	April	33	4.8	18.25	41.39	b72	2.53	1.58	10.10	58	3.21	3.96	10.4	a.930	a.253	a29.207
	Nov	33	4.0	11.53	38.14	82	2.50	1.56	10.12	84	b2.87	b3.38	9.9	.800	.181	29.105
	Feb	31	5.1	a22.94	10.21	80	.94	.59	11.09	b57	3.05	3.65	b9.0	a1.160	a.217	29.130
	Dec	27	3.9	13.19	27.59	82	1.72	1.08	10.60	81	b2.92	3.50	11.6	a1.317	a.314	29.148
	January	26	5.2	17.03	15.46	80	1.14	.71	9.97	67	b2.88	3.49	11.8	a1.356	a.319	a29.211
Cholera Infantum.																
More than Av. Per Ct. of Cholera Infantum.	Aug	35	3.8	a18.45	63.23	b78	5.29	3.31	8.37	54	b3.07	3.41	8.1	a.808	a.165	29.165
	July	22	4.1	22.09	71.13	71	6.12	3.83	7.85	41	2.47	3.00	7.6	a5.25	a.118	a29.150
	Sept	18	4.1	20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	a.737	a.173	29.209
Average		11	4.6	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Av. Per Ct. of Cholera Infantum.	Oct	8	5.0	16.81	a45.78	79	a3.17	1.98	9.70	59	3.03	b3.43	b8.2	.809	.182	29.161
	June	7	6.3	a22.73	a63.39	b70	a4.90	3.06	8.62	b41	b2.61	b3.20	b8.7	.655	.165	a29.195
	May	5	7.5	a19.72	a53.32	b69	a3.62	2.26	9.42	b50	2.96	3.68	b9.0	.709	.148	29.105
	Nov	4	7.0	11.53	38.14	82	2.50	1.56	10.12	84	b2.87	b3.38	9.9	.800	.181	29.105
	Jan	3	6.6	17.03	15.46	80	1.14	.71	9.97	67	b2.88	3.49	11.8	a1.356	a.319	a29.211
	Dec	2	4.3	13.19	27.59	82	1.72	1.08	10.60	81	b2.92	3.50	11.6	a1.317	a.314	29.148
	April	2	6.0	18.25	41.39	b72	2.53	1.58	10.10	58	3.21	3.96	10.4	a.930	a.253	a29.207
	March	1	7.5	a22.22	19.51	77	1.25	.78	10.90	b51	3.31	3.75	10.2	a1.068	a.267	a29.197
	Feb	1	6.5	a22.94	10.21	80	.94	.59	11.09	b57	3.05	3.65	b9.0	a1.160	a.217	29.130

*, †, ‡, §, ‖, ¶, **. See footnotes with these marks in Exhibit X, page 120.

a. Exceptions to Proposition 1, relating to diarrhea and cholera infantum, on pages 132–133.

b. Exceptions to Proposition 2, relating to diarrhea and cholera infantum, on pages 132–133.

EXHIBIT XX.—*By Year and Months for 1885 and an Average for the Nine Years 1877–85, Stating on what Per Cent of the Weekly Reports received* DIARRHEA, CHOLERA INFANTUM, INTERMITTENT FEVER, REMITTENT FEVER, TYPHOID FEVER, TYPHO-MALARIAL FEVER, MEASLES, *and* WHOOPING-COUGH *were Reported Present, and comparing the Per Cents for 1885 with the Averages for Corresponding Months in those Years.*

	Years, etc.	Year.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.		Year.	Jan.	Feb.*	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
Diarrhea.	Av. 9 years, 1877-85	47	27	28	29	32	36	46	73	86	81	57	36	28	Cholera Infantum.	13	2	2	2	2	3	10	31	48	36	13	4	2
	1884	52	28	27	26	38	45	52	73	88	88	70	46	35		15	1	3	4	6	5	14	29	43	47	22	7	3
	1885	46	26	31	35	33	36	44	65	77	65	44	33	27		11	3	1	1	2	5	7	22	35	18	8	4	2
	In 1885 **Greater** than Av. 1877-85	..	..	3	6	1	=	..	..	..	..	..	..	..		..	1	..	..	=	2	..	..	..	..	..	=	=
	In 1885 **Less** than Av. 1877-85	1	1	..	..	..	..	2	8	9	6	13	3	1		2	..	1	1	..	..	3	9	13	18	5	..	..
Intermittent Fever.	Av. 9 years, 1877-85	74	60	62	65	73	81	83	84	84	84	81	72	63	Remittent Fever.	50	41	40	42	45	48	50	53	60	62	60	50	44
	1884	65	56	56	57	65	68	72	76	73	73	72	62	53		44	38	40	40	42	40	43	50	47	53	54	43	40
	1885	59	51	52	51	57	64	68	67	65	65	60	55	49		36	33	32	43	38	33	35	32	39	40	39	38	31
	In 1885 **Greater** than Av. 1877-85	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	1	..	..	..	..	..	..	..	..	..
	In 1885 **Less** than Av. 1877-85	15	9	10	14	16	17	15	17	19	19	21	17	14		14	8	8	..	7	15	15	21	21	22	21	12	13
Typhoid Fever.	Av. 9 years, 1877-85	13	12	9	7	6	5	6	7	13	21	23	22	16	Typho-malari'l Fever.	23	18	16	14	12	12	13	16	25	41	45	34	23
	1884	12	10	7	8	6	5	4	7	14	19	23	24	13		20	14	12	13	11	12	12	14	23	33	39	33	23
	1885	8	11	7	5	4	3	5	5	6	11	13	16	8		16	15	16	14	10	11	10	10	15	24	25	21	14
	In 1885 **Greater** than Av. 1877-85	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	=	=	..	..	..	..	..	..	..	..	..
	In 1885 **Less** than Av. 1877-85	5	1	2	2	2	2	1	2	7	10	10	6	8		7	3	..	..	2	1	3	6	10	17	20	13	9
Measles.	Av. 9 years, 1877-85	13	11	13	17	23	27	22	15	7	5	5	6	7	Whooping-cough.	20	21	20	20	18	19	20	22	22	22	19	20	20
	1884	10	16	16	14	14	17	13	5	4	4	4	4	4		23	21	21	20	16	21	22	28	29	22	15	15	17
	1885	5	4	7	10	10	9	7	8	2	2	1	3	3		14	18	16	20	17	9	10	14	16	16	15	14	13
	In 1885 **Greater** than Av. 1877-85	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	=	..	..	..	..	..	..	..	..	..
	In 1885 **Less** than Av. 1877-85	8	7	6	7	13	18	15	7	5	3	4	3	4		6	3	4	..	1	10	10	8	6	6	4	6	7

* Other statements for 1885 and months in 1885 relative to these diseases are given in Table 2, pag 100–109, and in Exhibits XIX, XXI, XXII, and XXIII, pages 134, 137, 139, and 140, where are also given for convenient comparison statements of coincident meteorological conditions. The lines for 1885 are graphically represented in Diagrams 1, page 89, 3, page 138, and 4, page 128.

INTERMITTENT AND REMITTENT FEVER.

Exhibit XX indicates that for the year and for each month of the year 1885, intermittent fever shows a greatly decreased prevalence when compared with the average for the nine years 1877-85. The same is true in regard to remittent fever with the single exception of March, 1885, which shows a slight increase over the average for the nine years 1877-85. A study of the reported sickness from these diseases in connection with coincident weather by months in 1885 is given in Exhibit XXI, page 137.

TYPHOID AND TYPHO-MALARIAL FEVER.

Exhibit XX, page 135. shows that the average sickness from typhoid fever was less in 1885, and for each month in 1885 than the average for the nine years 1877-85. The same is true regarding typho-malarial fever except in the months February and March, when the sickness reported in 1885 was the same as the average for the nine years 1877-85. A study of the reported sickness from these diseases in connection with coincident weather in 1885 is given in Exhibit XXII, page 139.

MEASLES AND WHOOPING-COUGH.

By Exhibit XX it will be seen that the same remarks apply to measles and whooping-cough that are made regarding typhoid and typho-malarial fever except that in measles March is the only month in which the reports are the same as the average for nine years 1877-85.

EXHIBIT XXI.—INTERMITTENT FEVER AND REMITTENT FEVER. —*Stating for the Year and for each Month of the Year 1885, what Per Cent of the Weekly Reports of Diseases Stated Presence of Intermittent Fever, also of Remittent Fever, and what were the Meteorological Conditions, as Observed at Stations in Michigan.**

	Intermittent Fever. Months in Order of Greatest Per Cent of Weekly Reports Stating Presence of.	Per Cent of Weekly Reports Stating Presence of.†	Average Order of Prevalence where Present.†,‡	Temperature, F. Av. Daily Range, by Registering Thermometers.	Temperature, F. Av. of Three Daily Observations.	Humidity of Air.§ Av. of 3 Daily observations. Relative Per Cent of Saturation.	Humidity of Air.§ Absolute — Grains of Vapor in a Cubic Foot of Air.	Vapor Inhaled and Exhaled from Air Passages by one Person in 24 Hours. (Troy Ozs.) Inhaled.‖	Vapor ... Exhaled in Excess of that Inhaled.¶	Average Per Cent of Cloudiness.	Ozone—Relative Scale of 10°. Day Observation, 7 A. M. to 2 P. M.	Ozone—Night Observation, 9 P. M. to 7 A. M.	Average Velocity of Wind, Miles per Hour, by Anemometer.	Atmospheric Pressure. Inches. Reduced to 32° F. Range. Monthly, and for Year.	Range. Average Daily, by 3 Daily Observations.**	Average Pressure.
More than Av. Per Ct. of Intermittent Fever.	June	68	1.9	22.73	63.39	70	4.90	3.06	8.62	41	2.61	3.20	8.7	a.655	a.165	29.195
	July	67	2.0	22.09	71.13	71	6.12	3.83	7.85	41	2.47	3.00	7.6	a.525	a.118	a29.150
	Aug	65	2.3	a18.45	63.23	b 78	5.29	3.31	8.37	54	b3.07	3.41	8.1	a.808	a.165	29.165
	Sept	65	2.1	20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	a.737	a.173	29.209
	May	64	2.3	19.72	53.32	69	3.62	2.26	9.42	50	b2.96	b3.68	9.0	a.709	a.148	a29.105
	Oct	60	2.1	a16.81	45.78	b 79	3.17	1.98	9.70	b 59	b3.03	3.43	8.2	a.809	a.182	a29.161
Average		59	2.4	18.78	c42.36	76	c 3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Av. Per Ct. of Intermittent Fever.	Apr	57	2.7	18.25	41.39	b 72	2.53	1.58	10.10	58	3.21	3.96	10.4	a.930	a.253	a29.207
	Nov	55	2.4	11.53	38.14	82	2.50	1.56	10.12	84	b2.87	b3.38	9.9	.800	.181	29.105
	Feb	52	3.5	a22.94	10.21	80	.94	.59	11.09	57	3.05	3.65	b 9.0	a1.160	a.217	29.130
	Mar	51	3.5	a22.22	19.51	77	1.25	.78	10.90	b 51	3.31	3.75	10.2	a1.068	a.267	a29.197
	Jan	51	3.4	17.03	15.46	80	1.14	.71	9.97	67	b2.88	3.49	11.8	a1.356	a.319	a29.211
	Dec	49	2.7	13.19	27.59	82	1.72	1.08	10.60	81	b2.92	3.50	11.6	a1.317	a.314	29.148
REMITTENT FEVER.																
More than Av. Per Ct. of Remittent Fever.	Mar	43	3.7	22.22	a19.51	b 77	a1.25	.78	10.90	51	b3.31	b3.75	b10.2	1.068	.267	29.197
	Sept	40	3.0	20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	a.737	a.173	29.209
	Aug	39	2.9	a18.45	63.23	b 78	5.29	3.31	8.37	54	b3.07	3.41	8.1	a.808	a.165	29.165
	Oct	39	2.7	a16.81	45.78	b 79	3.17	1.98	9.70	b 59	b3.03	3.43	8.2	a.809	a.182	a29.161
	Apr	38	3.8	a18.25	a41.39	72	a2.53	1.58	10.10	b 58	b3.21	b3.96	b10.4	.930	.253	29.207
	Nov	38	3.1	a11.53	a38.14	b 82	a2.50	1.56	10.12	b 84	2.87	3.38	b 9.9	a.800	a.181	a29.105
Average		36	3.2	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Av. Per Ct. of Remittent Fever.	June	35	3.1	a22.73	a63.39	b 70	a4.90	3.06	8.62	b 41	b2.61	b3.20	b 8.7	- 6.55	.165	a29.195
	May	33	3.1	a19.72	a53.32	b 69	a3.62	2.26	9.42	b 50	2.96	3.68	b 9.0	.709	.148	29.105
	Jan	33	4.2	17.03	15.46	80	1.14	.71	9.97	67	b2.88	3.49	11.8	a1.356	a.319	a29.211
	Feb	32	4.2	a22.94	10.21	80	.94	.59	11.09	b 57	3.05	3.65	b 9.0	a1.160	a.217	29.130
	July	32	3.1	a22.09	a71.13	b 71	a6.12	3.83	7.85	b 41	b2.47	b3.00	b 7.6	.525	.118	29.150
	Dec	31	3.2	13.19	27.59	82	1.72	1.08	10.60	81	b2.92	3.50	11.6	a1.317	a.314	29.148

***,†,‡,§,‖,¶,**. See foot-notes with these marks in Exhibit X., page 120.**

a **Exceptions to Proposition 1, relating to intermittent and remittent fever, on page 133.**

b **Exceptions to Proposition 2, relating to intermittent and remittent fever, on page 133.**

c **There is for 1885 no exception to Proposition 1, relating to Intermittent Fever as regards Average Temperature and Absolute Humidity.**

DIAGRAM 3.—WEEKLY REPORTS OF DISEASES IN MICHIGAN, IN 1885.

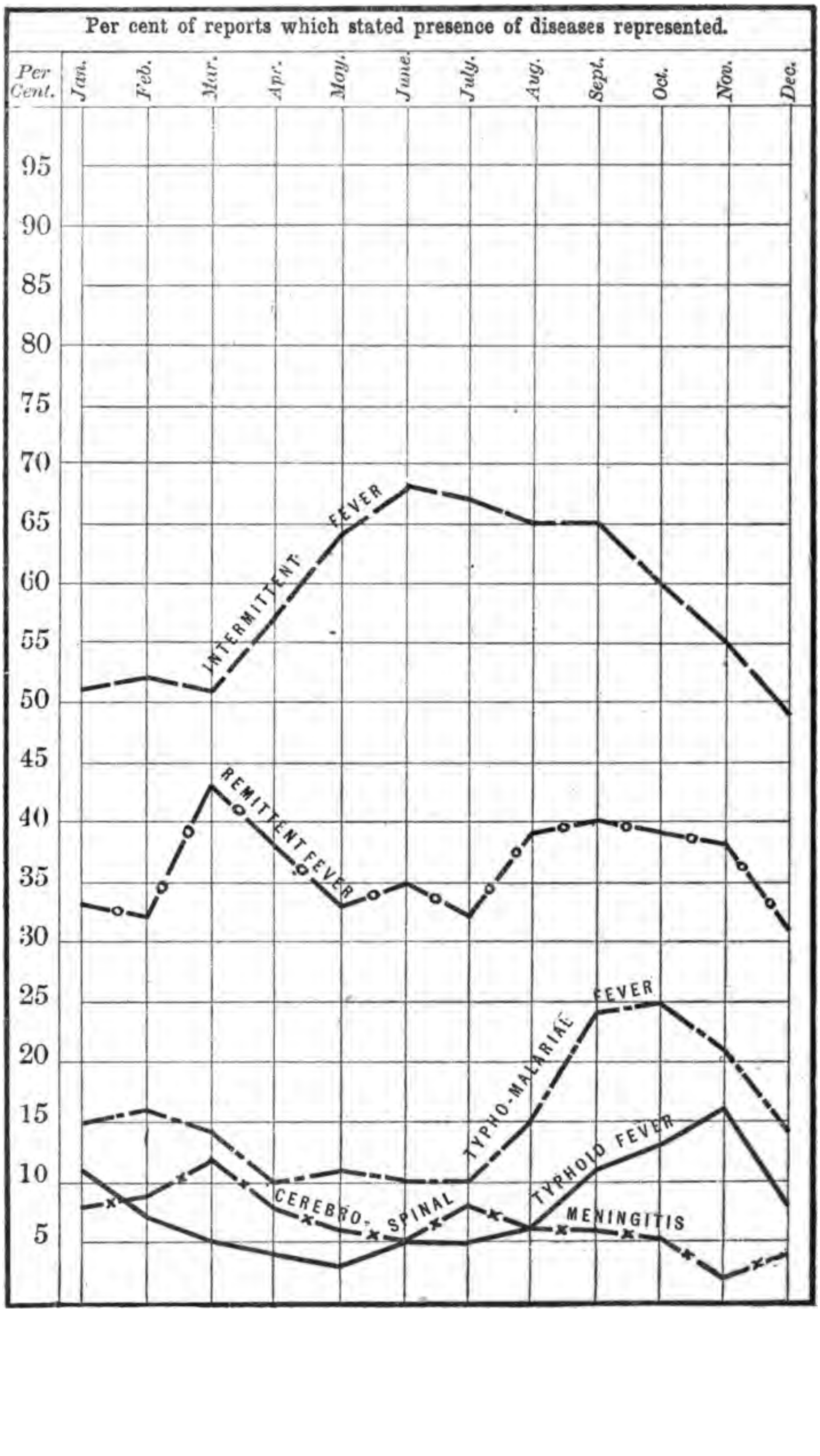


EXHIBIT XXII.—TYPHOID FEVER AND TYPHO-MALARIAL FEVER.—*Stating, for the Year and for each Month of the Year 1885, what Per Cent of the Weekly Reports of Diseases Stated Presence of Typhoid Fever; also of Typho-Malarial Fever, and what were the Meteorological Conditions as observed at Stations in Michigan.**

Typhoid Fever.				Temperature, F.		Humidity of Air.§ Av of 3 Daily Observations.		Vapor Inhaled and Exhaled, from Air Passages by one Person in 24 Hours. (Troy oz.)			Ozone,—Relative Scale of 10.°			Atmospheric Pressure.—Inches Reduced to 32° F.		
Months in Order of Greatest Per Cent of Weekly Reports Stating Presence of.		Per Cent of Weekly Reports Stating Presence of.*	Av. Order of Prevalence where Present.†,‡	Av. Daily Range by Registering Thermometers.	Av. of Three Daily Observations.	Relative Per Cent of Saturation.	Absolute Grains of Vapor in a Cubic Foot of Air.	Inhaled.‖	Exhaled in Excess of that Inhaled.¶	Average Per Cent of Cloudiness.	Day Observation, 7 A. M. to 2 P. M.	Night Observation, 9 P. M. to 7 A. M.	Average Velocity of Wind, Miles per Hour, by Anemometer.	Range. Monthly and for Year.	Range. Av. Daily by 3 Daily Observations.**	Average Pressure.
More than Av. Per Ct. of Typhoid Fever.	Nov....	16	4.2	a11.53	a38.14	b82	a2.50	1.56	10.12	b84	2.87	3.38	b9.9	a.800	a.181	a29.105
	Oct.....	13	4.0	a16.81	45.78	b79	3.17	1.98	9.70	b59	3.03	3.43	8.2	a.809	a.182	a29.161
	Sept. ..	11	4.1	20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	a.737	a.173	29.209
	Jan. ...	11	6.8	a17.03	a15.46	0	a1.14	.71	9.97	b	2.88	b3.49	b11.8	1.356	.319	29.211
Average........		8	4.7	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Average Per Cent of Typhoid Fever.	Dec....	8	4.8	13.19	27.59	82	1.72	1.08	10.60	81	b2.92	3.50	11.6	a1.317	a.314	29.148
	Feb....	7	6.3	a22.94	10.21	80	.94	.59	11.09	b57	3.05	3.65	b9.0	a1.160	a.217	29.130
	Aug. ..	6	4.3	18.45	a63.23	78	a5.29	3.31	8.37	b54	3.07	b3.41	8.1	.808	.165	a29.165
	March.	5	6.0	a22.22	19.51	77	1.25	.78	10.90	b51	3.31	3.75	10.2	a1.068	a.267	a29.197
	June ..	5	5.0	a22.73	a63.39	b70	a4.90	3.06	8.62	b41	b2.61	b3.20	8.7	.655	.165	a29.195
	July ...	5	4.9	a22.09	a71.13	b71	a6.12	3.83	7.85	b41	b2.47	b3.00	7.6	.525	.118	29.150
	April..	4	5.6	18.25	41.39	b72	2.53	1.58	10.10	58	3.21	3.96	b10.4	a.930	a.253	a29.207
	May...	3	5.4	a19.72	a53.32	b69	a3.62	2.26	9.42	b50	2.96	3.68	9.0	.709	.148	29.105
TYPHO-MAL. FEVER.																
More than Av. Pr. Ct. of Typho-Mal. Fev'r	Oct....	25	3.8	a16.81	45.78	b79	3.17	1.98	9.70	b59	b3.03	3.43	8.2	a.809	a.182	a29.161
	Sept. ..	24	4.1	20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	a.737	a.173	29.209
	Nov...	21	3.9	a11.53	a38.14	b82	a2.50	1.56	10.12	b84	2.87	3.38	b9.9	a.800	a.181	a29.105
Average.........		16	4.4	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Av. Per Cent of Typho-Malarial Fever.	Feb...	16	5.7	a22.94	10.21	80	.94	.59	11.09	b57	3.05	3.65	b9.0	a1.160	a.217	29.130
	Jan. ...	15	4.9	17.03	15.46	80	1.14	.71	9.97	67	b2.88	3.49	11.8	a1.356	a.319	a29.211
	Aug. ..	15	4.5	18.45	a63.23	78	a5.29	3.31	8.37	b54	3.07	b3.41	b8.1	.808	.165	a29.165
	March.	14	6.1	a22.22	19.51	77	1.25	.78	10.90	b51	3.31	3.75	10.2	a1.068	a.267	a29.197
	Dec....	14	4.4	13.19	27.59	82	1.72	1.08	10.60	81	b2.92	3.50	11.6	a1.317	a.314	29.148
	May...	11	4.3	a19.72	a53.32	b69	a3.62	2.26	9.42	b50	2.96	3.68	b9.0	.709	.148	29.105
	April..	10	5.9	18.25	41.39	b72	2.53	1.58	10.10	58	3.21	3.96	10.4	a.930	a.253	a29.207
	June ..	10	4.0	a22.73	a63.39	b70	a4.90	3.06	8.62	b41	b2.61	b3.20	8.7	.655	.165	a29.195
	July...	10	4.0	a22.09	a71.13	b71	a6.12	3.83	7.85	b41	b2.47	b3.00	b7.6	.525	.118	29.150

*, †, ‡, §, ‖, ¶, **. See foot-notes with these marks in Exhibit X, page 120.
a Exceptions to Proposition 1, relating to typhoid and typho-malarial fever, on page 133.
b Exceptions to Proposition 2, relating to typhoid and typho-malarial fever, on page 133.

EXHIBIT XXIII.—MEASLES AND WHOOPING-COUGH.—*Stating for the Year and for each Month of the Year 1885 what Per Cent of the Weekly Reports of Diseases Stated Presence of Measles, also of Whooping-cough, and what were the Meteorological Conditions as Observed at Stations in Michigan.**

	Months in Order of Greatest Per Cent of Weekly Reports Stating Presence of.	Per Cent of Weekly Reports Stating Presence of.†	Av. Order of Prevalence where Present.†‡	Temperature, F.: Av. Daily Range by Registering Thermometers.	Temperature, F.: Av. of Three Daily Observations.	Humidity of Air § Av. of 3 Daily Observations: Relative Per Cent of Saturation.	Humidity of Air § Av. of 3 Daily Observations: Absolute Grains of Vapor in a Cubic Foot of Air.	Vapor Inhaled and Exhaled, from Air Passages, by one Person in 24 Hours. (Troy oz.): Inhaled.‖	Vapor Inhaled and Exhaled, from Air Passages, by one Person in 24 Hours. (Troy oz.): Exhaled in Excess of that Inhaled.¶	Av. Per Cent of Cloudiness.	Ozone,—Relative Scale of 10°: Daily Observation, 7 A. M. to 2 P. M.	Ozone,—Relative Scale of 10°: Night Observation, 9 P. M. to 7 A. M.	Av. Velocity of Wind,—Miles per Hour,—by Anemometer.	Atmospheric Pressure. Inches. Reduced to 32° F.: Range: Monthly, and for Year.	Atmospheric Pressure. Inches. Reduced to 32° F.: Range: Av. Daily by 3 Daily Observations.**	Atmospheric Pressure. Inches. Reduced to 32° F.: Average Pressure.
MEASLES.																
More than Av. Per Cent of Measles.	March	10	6.8	22.22	a19.51	b77	a.25	.78	10.90	51	b3.31	b3.75	b10.2	1.068	.267	29.197
	April	10	5.6	a18.25	a41.39	72	a2.53	1.58	10.10	b58	b3.21	b3.96	b10.4	.930	.253	29.207
	May	9	4.8	19.72	53.32	69	3.62	2.26	9.42	50	b2.96	b3.68	9.0	a.709	a.148	a29.105
	July	8	5.9	22.09	71.13	71	6.12	3.83	7.85	41	2.47	3.00	7.6	a.525	a.118	a29.150
	June	7	5.2	22.73	63.39	70	4.90	3.06	8.62	41	2.61	3.20	8.7	a.655	a.165	29.195
	Feb.	7	7.1	22.94	a10.21	b80	a.94	.59	11.09	b57	b3.05	b3.65	9.0	1.160	.217	a29.130
Average		5	6.4	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Av. Per Cent of Measles.	Jan.	4	11.4	17.03	15.46	80	1.14	.71	9.97	67	b2.88	3.49	11.8	a1.356	a.319	a29.211
	Nov.	3	7.0	11.53	38.14	82	2.50	1.56	10.12	84	b2.87	b3.38	9.9	.800	.181	29.105
	Dec.	3	5.4	13.19	27.59	82	1.72	1.08	10.60	81	b2.92	3.50	11.6	a1.317	a.314	29.148
	Aug.	2	9.3	18.45	a63.23	78	a5.29	3.31	8.37	b54	3.07	b3.41	b8.1	.808	.165	a29.165
	Sept.	2	9.5	a20.42	a59.14	b75	a4.56	2.85	8.83	b44	b2.72	b3.14	b8.8	.737	.173	a29.209
	Oct.	1	10.0	16.81	a45.78	79	a3.17	1.98	9.70	59	3.03	b3.43	b8.2	.809	.182	29.161
WHOOPING-COUGH.																
More than Av. Per Cent of Whooping-cough.	March	20	4.8	22.22	a19.51	b77	a1.25	.78	10.90	51	b3.31	b3.75	b10.2	1.068	.267	29.197
	Jan.	18	4.5	a17.03	a15.46	b80	a1.14	.71	9.97	b67	2.88	b3.49	b11.8	1.356	.319	29.211
	April	17	4.5	a18.25	a41.39	72	a2.53	1.58	10.10	b58	b3.21	b3.96	b10.4	.930	.253	29.207
	Feb.	16	4.9	22.94	a10.21	b80	a.94	.59	11.09	b57	b3.05	b3.65	9.0	1.160	.217	a29.130
	Sept.	16	4.0	20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	a.737	a.173	29.209
	Aug.	16	3.1	a18.45	63.23	b78	5.29	3.31	8.37	54	b3.07	3.41	8.1	a.808	a.165	29.165
	Oct.	15	3.7	a16.81	45.78	b79	3.17	1.98	9.70	b59	b3.03	3.43	8.2	a.809	a.182	a29.161
Average		14	4.1	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Av. Per Cent of Whooping-cough.	July	14	4.1	a22.09	a71.13	b71	a6.12	3.83	7.85	b41	b2.47	b3.00	b7.6	.525	.118	29.150
	Nov.	14	3.8	11.53	38.14	82	2.50	1.56	10.12	84	b2.87	b3.38	9.9	.800	.181	29.105
	Dec.	13	3.8	13.19	27.59	82	1.72	1.08	10.60	81	b2.92	3.50	11.6	a1.317	a.314	29.148
	June	10	4.9	a22.73	a63.39	b70	a4.90	3.06	8.62	b41	b2.61	b3.20	b8.7	.655	.165	a29.195
	May	9	4.2	a19.72	a53.32	b69	a3.62	2.26	9.42	b50	2.96	3.68	b9.0	.709	.148	29.105

*, †, ‡, §, ‖, ¶, **. See foot-notes with these marks in Exhibit X, page 120.
a Exceptions to Proposition 1, relating to Measles and Whooping-cough, on page 133.
b Exceptions to Proposition 2, relating to Measles and Whooping-cough, on page 133.

EXHIBIT XXIV.—*Summary Relative to Propositions contained in Exhibits X, XII, XIV, XV, XVI, etc., (pages 120-127) concerning Relations, by Months in 1885, between Greater or Less than usual Prevalence of Diseases named, and certain given coincident Climatic Conditions.*

Diseases.	Months (inclusive) in which Diseases named were More than Usually Prevalent in 1885.	Months (inclusive) in which Diseases named were Less than Usually Prevalent in 1885.	For the 12 Months of the Year 1885, Number of Months in which Propositions Hold True.* — That in Months when Diseas's nam'd were more than Usually Prevalent the Conditions named below were Greater than Usual, and in Months when less than Usually Prevalent these Conditions were Less than Usual. — For Av. Daily Range of Temp.	Relative Humidity.	Av. Per Cent of Cloudiness.	Ozone. — Day.	Ozone. — Night.	Velocity of Wind.	Atmospheric Pressure. — Range. — Monthly.	Atmospheric Pressure. — Range. — Average Daily.	Atmospheric Pressure. — Average Daily.	That in Months when Diseases named were more than Usually Prevalent the Conditions named below were Lower than Usual, and in Mos. when the Diseases were Less than Usually prevalent these Conditions were Higher than Usual. — Average Temperature.	Absolute Humidity.
Bronchitis	Jan. to April, Nov., Dec.	May to October	4	9	9	6	10	11	11	11	6	12	12
Pneumonia	Jan. to May, Dec.	June to Nov.	6	7	7	8	11	9	11	11	6	10	10
Membranous Croup	Jan. to April, Dec.	May to Nov.	5	8	8	7	11	10	12	12	7	11	11
Diphtheria	April, Sept. to Dec.	Jan. to March, May to Aug.	3	6	9	5	5	8	6	6	5	7	7
Tonsilitis	Jan. to May, Nov., Dec.	June to Oct.	5	8	8	7	11	10	10	10	5	11	11
Influenza	Jan. to April, Nov., Dec.	May to Oct.	4	9	9	6	10	11	11	11	6	12	12
Scarlet fever	Jan. to July, Oct.	Aug., Sept., Nov., Dec.	8	5	5	7	8	5	7	7	6	5	6
Rheumatism	Jan. to June, Nov., Dec.	July to Oct.	6	7	7	6	10	9	9	9	6	10	10
Neuralgia	Jan. to April, Dec.	May to Nov.	5	8	8	7	11	10	12	12	7	11	11
Consumption	Jan. to April, June	May, July to Dec.	7	6	6	6	9	8	11	10	9	9	9

* The figures in each of these eleven columns show for how many months, out of the twelve months in the year 1885 the proposition named holds true; thus for Bronchitis, the proposition was true for only four months, so far as relates to average daily range of temperature; while the proposition relative to average temperature and absolute humidity holds true for all the 12 months of the year.

In Exhibits XXIV and XXV large numbers opposite any given disease indicate that the disease has close relations to the climatic conditions under which the large numbers stand; thus bronchitis, pneumonia, tonsilitis, and intermittent fever are much influenced if not controlled by certain meteorological conditions, the influence of which can undoubtedly eventually be learned.

EXHIBIT XXV.—*Summary Relative to Propositions contained in Exhibits XIX., XXI., XXII., XXIII., concerning Relations, by Months in 1885, between Greater or Less than Usual Prevalence of Diseases named, and certain given coincident Climatic Conditions.*

Diseases.	Months (inclusive) in which Diseases named were more than Usually Prevalent in 1885.	Months (inclusive) in which Diseases named were less than Usually Prevalent in 1885.	For the 12 Months of the Year, 1885, Number of Months in which Propositions hold True.* — That in Months when Diseases named were more Prevalent than usual the conditions named below were Higher than Usual, and in Months when the Diseases were Less Prevalent than Usual these Conditions were Lower than Usual.						That in Months when Diseases named were More Prevalent than Usual the conditions named below were Less than Usual, and in Months when the Diseases were Less Prevalent than Usual these conditions were Greater than Usual.				
						Atmospheric Pressure.					Ozone.		
						Range.							
			Av. Daily Range of Temp.	Av. Temperature.	Absolute Humidity.	Monthly.	Av. Daily.	Av. Daily.	Relative Humidity.	Av. Per Cent. of Cloudiness.	Day.	Night.	Velocity of Wind.
Diarrhea	July to Sept.	Jan. to June, Oct. to Dec.	7	9	9	4	4	7	9	8	7	9	8
Cholera Inf'm.	July to Sept.	Jan. to June, Oct. to Dec.	7	9	9	4	4	7	8	8	7	9	8
Int. Fever	May to Oct.	Jan. to April, Nov., Dec.	8	12	12	1	1	6	9	10	6	10	11
Remit't Fever.	Aug. to Nov., Mar. and Apr	Jan., Feb., May to July, Dec.	4	6	6	5	5	8	5	5	4	8	5
Typhoid Fever	Jan., Sept. to Nov.	Feb. to August, Dec.	4	6	6	5	5	6	5	3	9	8	7
Typh-mal. F.	Sept. to Nov.	Jan. to August, Dec.	5	7	7	4	4	5	6	4	7	9	6
Measles	Mar. to July, Feb.	Jan., August to Dec.	10	6	6	7	7	6	9	8	4	4	7
Whoop-cough.	Jan. to April, Aug. to Oct.	May to July, Nov., Dec.	5	5	5	8	8	9	4	5	3	5	6
Av. Disease	Jan. to April, Aug., Sept., Nov	May to July, Oct., Dec.	5	3	3	8	8	9	4	5	6	5	4

*The figures in each of these eleven columns show for how many months out of the twelve months in 1885, the proposition named over the column holds true; thus, concerning diarrhea, the proposition relative to Average Daily Range of Temperature held true in seven months out of the twelve: that relative to Average Temperature, nine months out of twelve, etc.

TOTAL SICKNESS—AVERAGE DISEASE.

"Average disease" is an average of the tabulated diseases reported present on all the cards received and compiled at this office during the year. It is probably equivalent to the actual sickness from all diseases printed on the report cards, and probably represents very nearly the average sickness from all the diseases in the State. A sample of the report cards on which diseases are reported to this office is found on page 84. Twenty-seven diseases are printed on the cards. In 1885 there were 5,108 of these card reports received. On some of the cards only one or two diseases were reported present; on others twenty or more were reported present. Had each disease (printed on this card, and only the twenty-seven thus named) been reported present on every card received at this office, there would have been 137,916 reports of diseases present. (This is the product of 5,108 reports received

multiplied by 27, the number of diseases printed on the cards, or 100 per cent of the possible disease-reports.) There were actually present on the cards received at this office only 35,752 disease-reports, which 35,752 ÷ 137,916 of the possible disease-reports that might have been present, is 26 per cent. This 26 per cent represents the actual sickness in the State, or, in other words, the sickness from "average disease."

What we term "average disease" is for the State the same as the per cent which the sickness reported by all observers is of the sickness which might have been reported on the 5,108 report cards received.

Exhibit XXVI. serves to indicate the probable actual sickness in the State in each year from 1877 to 1885. It compares the sickness in 1885, by months, with the sickness in each of the nine years 1877–1885. It also affords data for the comparison of the sickness in each month in each year from 1877 to 1885 with the sickness of 1885.

It will be seen by this exhibit that the sickness in 1885 was less than the average for the nine years, both for the year and for each month of the year.

EXHIBIT XXVI.—SICKNESS FROM AVERAGE DISEASE, 1877-85.—*By Year and Months for each of the Nine Years 1877–85, Stating on an Average for such of the 27 diseases tabulated as were reported present, what per cent of the Weekly Reports received stated presence of the Diseases, and comparing the Average Per Cents for Months in 1885 with the Averages for corresponding Months in those Years.*

Years, Etc.	Annual Av.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average 9 Years 1877-85	30	31	31	31	30	28	28	30	33	33	32	30	30
1877	28	27	28	26	24	24	23	26	29	31	30	30	30
1878	30	30	30	31	29	28	26	28	32	35	34	30	32
1879	33	35	36	36	35	30	30	32	37	36	34	34	33
1880	32	32	32	32	31	30	31	34	36	35	32	30	31
1881	33	34	34	32	35	31	30	34	37	36	35	32	31
1882	30	31	30	30	30	29	28	28	30	34	32	31	29
1883	30	30	31	33	33	31	29	29	32	32	29	29	28
1884	29	28	29	30	28	28	29	31	34	34	33	30	29
1885 (Diagram, page 131)	26	29	29	30	28	25	24	26	27	27	26	26	26
In 1885 **Greater** than Av. 1877-85	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
In 1885 **Less** than Av. 1877-85	4	2	2	1	2	3	4	4	6	6	6	4	4

RELATIONS OF TOTAL AMOUNT OF SICKNESS TO METEOROLOGICAL CONDITIONS.

PROPOSITION 1.—That in months when **more** than the average per cent of weekly reports stated the presence of such of the 27 diseases tabulated (in tables on pages 94–111) as were reported present, the average daily range of temperature, the average daily temperature, the absolute humidity of the atmosphere, the monthly and the average daily range of the barometer, and the average daily pressure of the atmosphere, were **greater** than the average for the year; and in months when **less** than the average per cent of reports

stated the presence of said diseases those conditions were **less** than the average for the year. In Exhibit XXVII, below, the letter *a* marks exceptions to this proposition for the year 1885.

PROPOSITION 2.—That in months when **more** than the average per cent of weekly reports stated the presence of such of the 27 diseases tabulated as were reported present, the relative humidity of the atmosphere, the average per cent of cloudiness, the ozone, and the average velocity of the wind were **less** than the average for the year; and in months when **less** than the average per cent of reports stated the presence of said diseases those conditions were **greater** than the average for the year. In Exhibit XXVII, below, the letter *b* marks exceptions to this proposition for the year 1885.

What per cent of the weekly reports received in 1885 (on an average for such of the tabulated diseases as were reported present) stated presence of the diseases, is graphically represented by months in Diagram 5, page 131.

EXHIBIT XXVII.—AVERAGE DISEASE.—*Stating for the Year and for each Month of the Year 1885, what Per Cent of the Weekly Reports of Diseases on an Average for such of the 27 Tabulated Diseases as were reported present, Stated Presence of the Diseases, and what were the Meteorological Conditions, as Observed at Stations in Michigan.**

Average Disease.				Temperature. F.		Humidity of Air.§ Av. of 3 Daily Observations.		Vapor Inhaled and Exhaled from Air Passages, by one Person in 24 Hours. (Troy Ozs.)			Ozone—Relative Scale of 10°.			Atmospheric Pressure. Inches. Reduced to 32° F.		
	Months in Order of Greatest Per Cent of Weekly Reports Stating Presence of.	Per Cent of Weekly Reports Stating Presence of.†	Av. Order of Prevalence where Present.†‡	Av. Daily Range by Registering Thermometers.	Average of Three Daily Observations.	Relative Per Cent of Saturation.	Absolute—Grs. of Vapor in a Cubic Foot of Air.	Inhaled.‖	Exh'l'd in excess of that Inhaled.¶	Av. Per Cent of Cloudiness.	Day Observation, 7 A. M. to 2 P. M.	Night Observation, 9 P. M. to 7 A. M.	Av. Velocity of Wind, Miles per Hour, by Anemometer.	Range. Monthly, and for Year.	Range. Av. Daily, by Three Daily Observations.**	Average Pressure.
More than Av. Per Ct. of Average Disease.	Mar	30	4.4	22.22	a19.51	b 77	a1.25	.78	10.90	51	b3.31	b3.75	b10.2	1.068	.267	29.197
	Jan	29	4.3	a17.03	a15.46	b 80	a1.14	.71	9.97	b 67	2.88	b3.49	b11.8	1.356	.319	29.211
	Feb	29	4.3	22.94	a10.21	b 80	a .94	.59	11.09	b 57	b3.05	b3.65	9.0	1.160	.217	a29.130
	Apr	28	4.1	a18.25	a41.39	72	a2.53	1.58	10.10	b 58	b3.21	b3.96	b10.4	.930	.253	29.207
	Aug	27	3.8	a18.45	63.23	b 78	5.29	3.31	8.37	54	b3.07	3.41	8.1	a.808	a.165	29.165
	Sept	27	3.7	20.42	59.14	75	4.56	2.85	8.83	44	2.72	3.14	8.8	a.737	a.173	29.209
	Nov	26	3.7	a11.53	a38.14	b 82	a2.50	1.56	10.12	b 84	2.87	3.38	b9.9	a.800	a.181	a29.105
Average		26	3.8	18.78	42.36	76	3.14	1.96	9.72	57	2.92	3.47	9.4	.906	.209	29.164
Less than Av. Per Ct. of Av. Disease.	July	26	3.7	a22.09	a71.13	b71	a6.12	3.83	7.85	b 41	b2.47	b3.00	b7.6	.525	.118	29.150
	Dec	26	3.6	13.19	27.59	82	1.72	1.08	10.60	81	a2.92	3.50	11.6	a1.317	a.314	29.148
	Oct	26	3.6	16.81	a45.78	79	a3.17	1.98	9.70	59	3.03	b3.43	b8.2	809	.182	29.161
	May	25	3.8	a19.72	a53.32	b 69	a3.62	2.26	9.42	b 50	2.96	3.68	b9.0	.709	.148	29.105
	June	24	3.8	a22.73	a63.39	b 70	a4.90	3.06	8.62	b 41	b2.61	b3.20	b8.7	.655	.165	a29.195

*, †, ‡, §, ‖, ¶, **, See footnotes with these marks in Exhibit X, page 120.
a Exceptions to Proposition 1, relating to Average Disease, on page 143.
b Exceptions to Proposition 2, relating to Average Disease, on page 144.

Exhibit XXVII, continued for a series of years, should supply answers to the questions as to what meteorological conditions are, on the whole, most conducive to health in Michigan, and what are most to be guarded against by residents in Michigan.

DISEASES REPORTED ON THE CARDS IN ADDITION TO THOSE TABULATED IN THIS REPORT, REMARKS RELATIVE TO HEALTH OR SICKNESS, ETC.

The names of twenty-seven diseases are printed on the report-cards. Near the bottom of the cards are one or two blank lines on which other diseases may be reported, or remarks inserted in regard to marked increase or decrease of any disease. "If any disease not printed on the card has a greater number of cases, and is, therefore, higher in the 'order of prevalence,' than some other disease printed on the card, it should be written on the card with its proper number opposite; as should, also, any other important disease." It is desirable that diseases that become suddenly prevalent or that suddenly disappear, or such diseases as result in an unusual death rate or seem to be influenced by peculiar atmospheric conditions, shall be noticed by the observers, and remarks inserted in the blank spaces provided for that purpose.

During the year 1885, parotitis was reported on sixty-two cards, chicken-pox on twenty-five, German measles on twenty-four, spasmodic croup on twenty-three, cystitis on fourteen, peritonitis on eleven, pleuritis and diabetis on eight, chorea and cancer on seven, pharyngitis, dyspepsia and purpura on five cards.

Besides the above reports for the year, there were reported in *January*, sore throat at Houghton, eczema at Lake township, jaundice at Evangeline township, acute catarrh at Lowell, endocarditis, itch at Hubbardston, epilepsy at Ithaca, asthma at Portland, perityphlitis at Memphis, sore throat at Northville, conjunctivitis at Richmond; in *February*, ulcerated sore throat at Houghton, otitis and eczema at Lake township, dropsy at Columbiaville, itch at Hubbardston, ascites at Ithaca, coughs and colds, and sore throat at Northville; in *March*, gastritis at Lake township, laryngitis at Algonac, dropsy at Columbiaville, catarrhal fever at Dansville, itch at Hubbardston, eczema at Ithaca, asthma at Portland, bilious colic at Saugatuck, stomatitis at Kalamazoo, sore throat and colds at Memphis; in *April*, eczema at Lake township, jaundice at Thornville, itch at Hubbardston, phlegmasia dolens, angina pectoris, and hepatitis at Ithaca, dropsy at Vernon, roseola and erythema nodosum at Kalamazoo, bilious attacks at Ypsilanti, follicular sore throats and biliousness at Northville, laryngitis at Richmond; in *May*, eczema at Lake township, malignant pustule at Charlevoix, sciatica at Sand Lake, opthalmia at Emmet, puerperal convulsions at St. Charles, paralysis at Dansville, itch at Hubbardston, chlorosis and scarlet rash at Ithaca, congestion of brain and puerperal mania at Benton Harbor, stomatitis and laryngitis at Kalamazoo, bilious attack at Ypsilanti, hysteria, scrofula, and jaundice at New Baltimore, biliousness at Northville, urticaria, gastritis and gastric catarrh at Oxford; in *June*, gastritis at Harrisville, rötheln epidemic at Columbiaville, enteritis at Greenville, chlorosis and phlegmasia dolens at Ithaca, congestion of lungs at Breedsville, bilious attacks at Ypsilanti, pelvic abscess and phlegmasia dolens at Memphis, scrofula at New Baltimore, bilious indigestion at Northville; in *July*, ulcerated sore throat at Hough-

ton, dropsy at West Branch, heat prostration and bilious fever at Newaygo, paralysis at Columbiaville, sunstroke at Port Huron, acute catarrh at St. Charles, angina pectoris at Flint, gastritis at Ithaca, biliary catarrh at Vernon, hemorrhage of lungs at Jackson, puerperal convulsions and apoplexy at Kalamazoo, bilious attacks at Ypsilanti, bilious indigestion at Northville, gastritis at Oxford; in *August*, dropsy at Lake township and West Branch, gastritis and pericarditis at Ithaca, syphilis at Lawrence, bilious colic at Three Oaks, bilious sore throat at Jonesville, tabes mesenterica at Kalamazoo, tetanus at Springport, bilious attacks at Ypsilanti, shingles at Memphis; in *September*, dropsy at West Branch, hay fever at Ithaca, tabes mesenterica at Sheridan, epilepsy at Jackson, catarrhal laryngitis at Holly, gastritis at Oxford; in *October*, dropsy at West Branch, syphilis at Harrison, eczema at Ithaca, tabes mesenterica at Sheridan, cerebral hemorrhage at Vernon, metritis at Benton Harbor, catarrhal fever at Hanover, milk leg at Richland, continued fever at Detroit, diphtheritic sore throat at Northville, gastritis at Northville; in *November*, dropsy at West Branch, stomatitis and ulcers at Big Rapids, hemiplegia and parametritis at Vernon, metritis at Benton Harbor, diphtheritic croup at Lawrence, milk leg at Richland, tubercular meningitis at Detroit; in *December*, ulcerated sore throat at Houghton, hemorrhage at Lake township, cancer of stomach at Grandville, gastritis and gastric ulcer, epidemic tonsilitis at Vernon township, congestion of lungs at Breedsville, itch at Burr Oak, congestion of liver at Hudson, myalgia and stomatitis at Kalamazoo, ulcerated sore throat and bilious attacks at Ypsilanti, irritation of air passages at Northville, paralysis at New Haven, gastric ulcer at Oxford.

Several times during the year 1885 physicians have reported on the cards, from different localities in the State, "very little sickness," "much less sickness than usual," "very healthy," "distressingly healthy," "less sickness than for the last six years," "never knew so little sickness," "not a case of sickness in town," etc. Only twice has there been mentioned an increase of sickness, and then only when compared with the previous week.

RELATION OF PREVALENCE OF DISEASES TO METEOROLOGICAL CONDITIONS.

On page 89 and on following pages graphic illustrations are given in Diagrams 1 to 5 of the time of greatest and of least prevalence in 1885 of each of twenty-seven diseases. By comparing these diagrams with those illustrating the meteorological conditions by months in 1885, in the article on "Meteorological Conditions in Michigan," it will be found that for many of the diseases the time of greatest prevalence follows about one month behind the time of the highest (or lowest) meteorological conditions directly affecting the disease.

By our method of reporting each disease so long as it is under observation, sickness will, of course, appear to follow or coincide with the changes in meteorological conditions, according to whether the average duration of the disease is more or less than two weeks; because, although the reports are made weekly, the tables and diagrams do not shew shorter periods than one month; therefore, when the disease lasts longer than half of the period, sickness from it due to a change in one month will be likely to continue into the next month. That the time of greatest prevalence of some of the diseases follows uniformly certain meteorological conditions directly affecting these

diseases might be shown by arranging in the tabular Exhibits X. to XXII., the meteorological conditions for the preceding month in each case opposite the month for which the per cent of reports is given, and noting the exceptions to the propositions and summarizing them in a manner similar to that in Exhibits XXIV. and XXV., on pages 141 and 142. It has not been thought best, however, to do this in the present report, partly because it has been found that an excellent way to study the relations of diseases to meteorological conditions, and perhaps a better way than by means of tables, is by means of diagrams which exhibit plainly to the eye the relation of the sickness from a given disease in any given month to certain meteorological conditions not only in that month, but also in the month or months preceding. Such a study of one important disease was published in the Annual Report of this Board for 1884, under the title "Typhoid Fever and Low Water in Wells." It is expected that similar studies of the causation of the most important diseases will be made and published in subsequent annual reports of this Board, and that one important disease, namely, pneumonia, will be thus treated further on in this Report.

THE PREVENTION OF TYPHOID FEVER.

SOMETIMES CALLED "ENTERIC FEVER," "GASTRIC FEVER," OR "PYTHOGENIC FEVER," AND BY THE GERMANS "ABDOMINAL TYPHUS."

DOCUMENT ISSUED BY THE MICHIGAN STATE BOARD OF HEALTH.

[99.] JANUARY, 1886.

Typhoid fever is a common and protracted disease, terminating fatally in about one case out of eight or ten.

The number of deaths returned as having occurred in Michigan from typhoid fever averages about five hundred per year; but it is believed that only about one-half of the deaths are reported, so that the number of deaths which actually occur in Michigan from typhoid fever is probably about one thousand per year; and the number of persons in Michigan sick with typhoid fever is probably about eight or ten thousand each year. A large proportion of that sickness and mortality can be and ought to be prevented.

The greatest number of deaths from this disease is of persons in the prime of life, and this should prompt to greater efforts for the prevention of the disease. Persons of all ages have the disease, and even though they have it in many instances in a mild form, yet they may be the medium of communicating the disease in a fatal form to others, for although it is not one of the most contagious diseases, **Typhoid Fever is believed to be a communicable disease.**

Typhoid fever is believed by many to be caused by a special contagium and nearly all agree that the poison, whether specific or not, may be conveyed to other persons by drinking water contaminated by discharges from the bowels of a person affected with the disease, or by leachings from the bodies of those who have died of typhoid fever.

Mode of Spread or Communication.—Experience seems to prove that, with certain precautions, attendants upon those sick with typhoid fever are not in danger of contracting this disease directly from the patient. Water chemically impure does not necessarily cause the disease; but drinking-water contaminated with the fecal discharges of a typhoid-fever patient is believed to be the most common source or vehicle of typhoid fever. While the possibility of its originating in other ways is not denied, the frequent

outbreaks of this disease which are traceable directly and unmistakably to a contaminated water-supply, seem to point to this as the chief source of danger. The disease has also been traced to milk diluted with infected pump-water, and apparently in some cases to emanations from sewers and cesspools. It seems to prevail most in times of drought, in the fall of the year, especially after a period of high temperature, and when the water in wells is low and its contaminations most concentrated.

Filth and bad sanitary condition of premises generally, probably increase the danger of spreading the disease. Typhoid fever has been styled a "filth disease."

Protect the Water-supply.—The most scrupulous care should be taken to keep the present sources of drinking-water pure, and to procure future supplies only from clean sources. The general water-supply of cities and villages is a matter of the greatest concern, and should be procured from places where there can be no probability of immediate or remote contamination. The well-known outbreak of typhoid fever at Plymouth, Pa., where over a thousand cases and many deaths occurred, is apparently an illustration of how great a calamity may follow the fouling of a *general* water-supply by the discharges of a person sick with typhoid fever. When there is no general water-supply, much may be done to protect the wells by the abolition of cess-pits, and privy-vaults, by the use of dry earth in privies and by the frequent removal therefrom of all their contents.

Great care should be had to prevent the contamination of the water-supply by discharges from the bowels of a person sick with typhoid fever, as by drainage into wells, springs, or other water-supply, from a privy-vault, sewer, drain, or cemetery. Privies often drain into wells, unsuspected by those who use the water. Should typhoid discharges pass into such a privy, an outbreak of typhoid fever among those using the water from a neighboring well would be likely to occur. If such a well were the source of the general water-supply of a city, typhoid fever might soon be epidemic there. Extraordinary care should be taken to prevent typhoid fever discharges from entering any general water-supply from a well or from a small stream. The use of water from a source likely to be infected with excreta from a typhoid fever patient should be promptly stopped; and great care should also be given to the milk supply.

There is good reason to suspect the water of a well whenever a vault is situated within one hundred feet of it, particularly if the soil be porous. In numerous instances fluids from excreta have leached into wells from much greater distances; and it has been proved that a well thirty rods from a cemetery received water which had filtered through the soil of the cemetery.* Dangerously contaminated water may be, and often is found to be, clear and colorless, and to have no bad taste.

Period of Incubation.—The interval of time between receiving the cause of typhoid fever into the system and becoming sick therefrom is not uniform; but it is very often about eleven days, sometimes as long as twenty-one days.

Householders and Physicians must immediately give notice of the first case, and of every case of a "disease dangerous to the public health," and such is typhoid fever, to the health officer or to the board of health. This

* Page 66, Ypsilanti Sanitary Convention, Supplement to the Annual Report of the Michigan State Board of Health, 1885.

is required by sections 1734 and 1735, Compiled Laws of Michigan, 1871, as amended by Act No. 11, Laws of 1883, which, with the new section (50) added in 1883, are as follows:

(1734.) SEC. 43. Whenever any **householder, hotel keeper, keeper of a boarding house, or tenant** shall know, or shall be informed by a physician, or shall have reason to believe, that any person in his family, hotel, boarding house, or premises is taken sick with small-pox, cholera, diphtheria, scarlet fever, or any other disease dangerous to the public health, he shall immediately give notice thereof to the health officer, the president or the clerk of the board of health of the township, city, or village in which he resides. Said notice shall state the name of the person sick, the name of the disease, the name of the householder, hotel keeper, keeper of boarding house, or tenant giving the notice, and shall, by street and number, or otherwise, sufficiently designate the house in which he resides or the room in which the sick person may be; and if he shall refuse or neglect immediately to give such notice he shall forfeit for each such offense a sum not exceeding one hundred dollars*: *Provided*, That this penalty shall not be enforced if a physician in attendance has given to the health officer or other officer hereinbefore mentioned an immediate notice of said sick person, and true name of the disease, in accordance with the requirements of this section.

(1735.) SEC. 44. Whenever any **physician** shall know that any person whom he is called to visit, or who is brought to him for examination, is infected with small-pox, cholera, diphtheria, scarlet fever, or any other disease dangerous to the public health, he shall immediately give notice thereof to the health officer, the president, or the clerk of the board of health of the township, city, or village in which the sick person may be; and to the householder, hotel keeper, keeper of a boarding house, or tenant within whose house or rooms the sick person may be. The notice to the officer of the board of health shall state the name of the disease, the name, age, and sex of the person sick, also the name of the physician giving the notice; and shall, by street and number, or otherwise, sufficiently designate the house or room in which said sick person may be. And every physician and person acting as a physician, who shall refuse or neglect immediately to give such notice shall forfeit for each such offense a sum not less than fifty nor more than one hundred dollars*: *Provided*, That this penalty shall not be enforced against a physician if another physician in attendance has given to the health officer, or other officer hereinbefore mentioned, an immediate notice of said sick person, and the true name of the disease, in accordance with the requirements of this section.

SEC. 50. For each complete notice in writing to an officer of the board of health, in full compliance with the preceding section, requiring from physicians or other persons notices of diseases dangerous to the public health, the physician who gave the notice shall be entitled, on duly certifying that each notice was correct, and when the bill has been duly audited by the board of health, to receive from the township, city or village, in which the notice was given, the sum of ten cents.

Upon receipt of such notice, the local board of health has duties to perform in taking measures to restrict the spread of the disease, which it is a great violation of public trust for the board to neglect or postpone. The law is very plain as to the nature and the importance of these duties. One section of the law is as follows:

Notice of infected places. (1732.) SEC. 41. When the small-pox, *or any other disease dangerous to the public health*, is found to exist in any township, *the board of health shall use all possible care to prevent the spreading of the infection*, and *to give public notice of infected places* to travelers, by such means as in their judgment shall be most effectual for the common safety.

Some of the duties of the local board of health, and of the health officer. In order that no time may be lost, it is the duty of every board of health to make provision for prompt action by its health officer, authorizing and directing him to be prepared at all times, as executive officer of the board, to take certain action without waiting for a meeting of the board whenever a case of typhoid fever occurs within its jurisdiction. Some of these duties of the health officer may be briefly suggested as follows: He should:—

1. Give public notice of infected places, so that no person may unguardedly drink water or take food from a source likely to be contaminated.

---

* **Supervisors** must prosecute for all such forfeitures; township officers must give notice to supervisor; prosecuting attorney to conduct suit if requested; see sections 6852, 6853, and 6855, Compiled Laws of Michigan, 1871. **Health officers of villages and cities** must notify prosecuting attorney of all violations of this section—see Act No. 157, Laws of 1879; the **prosecuting attorney** must prosecute for all such forfeitures incurred within his county,—see section 6855, Compiled Laws of 1871.

2. Investigate the probable source and mode of origin of the disease. If probably from a contaminated well or general water-supply, see that measures are taken by stopping its use, by boiling it, or otherwise to prevent further cases being caused in the same manner.

3. Order and enforce the disinfection of all discharges from the bowels of patients sick with typhoid fever. It is safest that the discharges of all persons who have diarrhea shall be disinfected.*

4. Disinfect the contents of the privy on the premises, or any other that has been used by the patient.†

5. Order and secure the disinfection of all articles of clothing or bedding that have been soiled by discharges from the patient.

6. Secure the coöperation of the people in the prevention of this disease, by teaching them its modes of spread, the best methods for its prevention, and the greater importance of efforts for its prevention in times of drought and low water in wells.‡

7. Act 137, laws of 1883, specifies several other duties which the health officer should perform, among which may be mentioned, as especially applicable in this disease, the disinfection of the room and all articles likely to be infected, before allowing their use by other persons; the prompt and full reports to the Secretary of the State Board of Health, as well as to the president of the local board of health.

The local board of health and the physician in charge of a case of this disease should coöperate for its restriction. The local board of health should especially guard against its spread by cases where no physician is employed.

Personal Precaution.—Do not drink water which has a bad taste or odor, or which comes from a source that renders it liable to be impure, especially if there is reason to believe that it may contain something derived from a person sick with typhoid fever.

Disinfect the Bowel Discharges of the Sick.—This is a measure of prime importance. The discharges are believed to acquire more virulent properties, after a few days, particularly when thrown, without disinfection, into a vault or other receptacle of decomposing filth. The bowel discharges should, therefore, in all cases, be received upon papers or old cloths and promptly burned, or be received in vessels and thoroughly disinfected as follows: Disinfect each discharge from the bowels by thoroughly mixing with it at least one ounce of chlorinated lime in powder, or one quart of "Standard Solution, No. 1," recommended by the American Public Health Association's committee.§ In country districts, villages, and small cities, where the privy is not far distant from a well, the discharges should not be thrown into a privy-vault, but, after being disinfected, they should be carried a

* Even cases so lightly sick as to be able to walk about and work are very dangerous; as in the well known case at Caterham, England, where, in 1879, 352 cases of fever were caused, it is believed, by the diarrheal discharges from one such workman getting into the general water-supply of the towns of Caterham and Red Hill.

† **How isolated privies may become infected** is illustrated by a case of a peddler sick with typhoid fever, admitted into Bellevue Hospital, New York City, who is reported to have said that while suffering from the diarrhea in the early stages of his disease, he had visited between forty and fifty different privies.

‡ Pamphlets containing such information, issued by this State board of health, for distribution to neighbors of families in which there is typhoid fever, or to other persons likely to read them, may be had on application to the Secretary of the State Board of Health at Lansing.

§ "Standard Solution No. 1," of the American Public Health Association's Committee, is made by adding to each gallon of soft water, four ounces of chloride of lime of the best quality, which should contain at least 25 per cent of available chlorine. "Use one quart of this solution for the disinfection of each discharge in cholera, typhoid fever, etc. Mix well and leave in vessel for at least one hour before throwing into privy-vault or water-closet."

greater distance from any source of drinking-water and then covered with earth.

Rags, closet-paper, or other similar material used about the patient should be immediately burned.

Soiled clothing, towels, bed-linen, etc., on removal from the patient, should soon be placed in a pail or a tub of boiling-hot zinc solution, made in proportions as follows: Water, one gallon; sulphate of zinc, four ounces; common salt, two ounces. Soiled clothing should, in all cases, be disinfected before sending away to a laundry, either by boiling for at least half an hour (it may well be boiled in the zinc solution), or by soaking in a strong solution of chlorinated soda.

Bodies of those dead from typhoid fever should be wrapped in a cloth wet with a strong solution of chlorinated soda, or with "Standard Solution No. 1," * or with a zinc solution, and at once buried; the zinc solution should be made in proportions of one-half pound of chloride of zinc to one gallon of water, or as follows: Water, one gallon; sulphate of zinc, eight ounces; common salt, four ounces.

After a death or recovery from typhoid fever the room in which there has been a case of typhoid fever, whether fatal or not, should, with all its contents, be thoroughly disinfected by exposure for twenty-four hours to strong fumes of burning sulphur, and then it should for several hours, if possible for days, be exposed to currents of fresh air.

Rooms to be disinfected by sulphurous fumes must be vacated. For a room ten feet square, at least three pounds of sulphur should be used; for larger rooms proportionately increased quantities, at the rate of three pounds for each one thousand cubic feet of air-space.

Hang up and spread out as much as possible all blankets and other articles to be disinfected; turn pockets in clothing inside out, and otherwise facilitate the access of the sulphurous fumes to all infected places.

Close the room as tight as possible, place the sulphur in iron pots or pans which will not leak, supported upon bricks over a sheet of zinc or in a tub containing water, so that in case melted sulphur should leak out of the pot the floor may not be burned; set the sulphur on fire by hot coals or with the aid of a spoonful of alcohol lighted by a match; be careful not to breathe the fumes of the burning sulphur, and when certain the sulphur is burning well leave the room, close the door, and allow the room to be closed for twenty-four hours.

It is especially important that the *contents* of the privy be disinfected. For this purpose use four ounces of the best quality of "chloride of lime" to each gallon of material in the vault.

Boil the Drinking Water.—Immediately on the appearance of typhoid fever a careful examination should be made of the surroundings of the house, and particularly of the source of the water used, to determine, if possible, whether it has been contaminated by leachings from privies or other sources of filth. If the sick person has been at home, and not away where the disease might be contracted, it will be safest that the water used by the sick person immediately before having been taken sick should not be used again for drinking or culinary purposes unless it is boiled. It is believed that

* To each gallon of soft water, add four ounces of "chloride of lime" of the best quality, which should contain at least 25 per cent of available chlorine.

thorough boiling will destroy the germs or poison of the disease. Ordinary filtering will not do so.

Separation of the Sick from the Well.—As typhoid fever is seldom, if ever, transmitted directly from one person to another, strict isolation is not necessary or important in preventing its spread. It would be wise, however, for all who can properly do so, to keep away from the premises.

Perfect cleanliness of nurses and attendants should be enjoined and secured. As the hands of nurses may become contaminated by the poison of the disease, a good supply of towels and basins,—one containing a solution of chlorinated soda,* chlorinated lime, or the zinc-solution, and another for plain soap and water,—should always be at hand and freely used.

With the view of lessening the number of cases of and deaths from typhoid fever in Michigan, the foregoing is published by the STATE BOARD OF HEALTH for free distribution throughout the State, especially to officers and members of local boards of health. Physicians being to some extent the custodians and conservators of the public health, copies of this document are also sent to physicians in Michigan, in the hope that they will aid in diffusing among the people such knowledge of the nature of typhoid fever as will enable the people better to co-operate with them and with boards of health for the restriction of the disease and a decrease of sickness and deaths therefrom.

Any communication upon the subject may be addressed to: OFFICE OF STATE BOARD OF HEALTH, LANSING, MICHIGAN, from which, on application, any person may obtain a copy of this document or other papers containing more complete statements relative to this disease.

In order that the document may do the greatest possible good, it is hoped that each one who receives it will not only make such use of it as will tend to disseminate most widely the suggestions and statements of facts contained therein, but will also *act for the restriction or prevention of this disease* in accordance with its suggestions, or by other effective measures.

After reading this document with sufficient care to remember the principles involved, please preserve it for future reference.

* To one part of Labarraque's Solution (liquor sodæ chlorinatæ), add five parts of soft water.

TYROTOXICON;

ITS PRESENCE IN POISONOUS ICE CREAM; ITS DEVELOPMENT IN MILK; AND ITS PROBABLE RELATION TO CHOLERA INFANTUM AND KINDRED DISEASES.*

BY VICTOR C. VAUGHAN, M. D., PH. D., PROFESSOR OF PHYSIOLOGICAL CHEMISTRY IN THE UNIVERSITY OF MICHIGAN, MEMBER OF THE STATE BOARD OF HEALTH.

About one year ago, and after two years of close investigation, the writer succeeded in isolating from some samples of cheese, which had produced alarming symptoms in many persons, a highly poisonous ptomaine, to which the name tyrotoxicon (cheese poison) was given. The effects of this poison were demonstrated repeatedly upon some of my students, who kindly offered themselves as subjects of experimentation, and upon myself. These were found to agree closely with those observed by the physicians who treated the persons made sick by eating of the cheese. There were reported to the Michigan State Board of Health about 300 cases. The most prominent symptoms were dryness and constriction of the fauces, nausea, retching, vomiting and purging.

The vomited matter was frothy and the stools watery. In some there were evidences of marked nervous depression. Although in many the condition seemed alarming, all finally recovered.

A report of the discovery of tyrotoxicon in cheese will be found in *Zeitschrift für physiologische Chemie*, B. X, Heft 2; also in the Annual Report of the Michigan State Board of Health, for the year 1885.

Last November a student brought to me a four ounce bottle partly filled with milk which had stood tightly closed with a glass stopper for about six months. From this I succeeded in isolating the same poison. It was recognized by its crystalline appearance and by its effect upon myself. It was presumed that this milk was normal in composition when first obtained; but of this we could not be certain.

I then put several gallons of normal milk in perfectly clean bottles with glass stoppers and allowed these to stand in my work room. From time to time a bottle was opened and the test for tyrotoxicon was made. These tests were followed by negative results, until about three months after the experiment was begun. I then succeeded in getting the poison from one of the bottles. The method of testing for it was as follows: The coagulated milk was filtered through heavy Swedish filter paper. The filtrate was colorless and decidedly acid in reaction. It was rendered feebly alkaline by the addition of potassium

* This paper was read at the meeting of the State Board of Health, July 13, 1886.

hydrate, then agitated with ether. After separation the ethereal layer was removed with a pipette, allowed to run through a dry filter paper to remove a flocculent, white substance which floated in it, and then allowed to evaporate spontaneously. If necessary this residue was dissolved in water and again extracted with ether. On the evaporation of the ether the tyrotoxicon was recognized by its crystalline appearance, by its odor, and by placing a small bit on the tongue. As the ether takes up some water, there is usually enough of the latter left after the spontaneous evaporation of the ether to hold the poison in solution, and in order to obtain the crystals this aqueous solution must be allowed to stand for some hours in vacuo over sulphuric acid.

From one half gallon of the milk there was obtained quite a concentrated aqueous solution of the poison after the spontaneous evaporation of the ether. Ten drops of this solution placed in the mouth of a small dog three weeks old caused, within a few minutes, frothing at the mouth, retching, the vomiting of frothy fluid, muscular spasm over the abdomen, and after some hours watery stools. The next day the dog seemed to have partially recovered, but was unable to retain any food. This condition continuing for two or three days, the animal was killed with chloroform. No examination of the stomach was made.

It may be remarked here that I have elsewhere pointed out the necessity of using pure ether for these extractions, as some samples of ether contain an irritating, ptomaine-like substance.

June 13, 1886, I received from Dr. Henry B. Baker, Secretary of the Michigan State Board of Health, a pint bottle about two-thirds full of melted ice cream, with the request that I analyze it, as some 18 persons had been seriously affected by eating of it. Dr. Baker also sent some of the vanilla which had been used as flavoring. It was thought that the poison would be found in the vanilla, because some lemon ice cream furnished at the same gathering had not affected those who ate of it. As the readiest means of deciding this, my assistant, Mr. Novie, and myself took at first 30 drops each of the vanilla extract. No ill effects following this, Mr. Novie took two teaspoonsful more, with no results. This settled the question of the poisonous nature of the vanilla more satisfactorily than could have been done by a chemical analysis.

We then added some distilled water to the cream, and, after thorough agitation, filtered it. The filtrate was tested for tyrotoxicon by the method already given. The aqueous solution, after the spontaneous evaporation of the ether, was given to a cat. Within ten minutes the cat began to retch, and soon it vomited. This retching and vomiting continued for two hours, during which time the animal was under observation, and the next morning it was observed that it had passed several watery stools. After this, although the cat could walk about the room, it was unable to retain any food. Several times it was observed to lap a little milk, but on doing so it would immediately begin to retch and vomit. Even cold water produced this effect. This condition continuing, after three days the animal was placed under ether and its abdominal organs examined. We certainly expected to find marked inflammation of the stomach. But we really did find the stomach and small intestines filled with a frothy, serous fluid, such as had formed the vomited matter, and the mucous membrane very white and soft. There was not the slighest redness anywhere. The liver and other abdominal organs seemed to be normal.

It should be remarked that this cat was about two months old. Attention

is called to this, because young animals are affected by this poison much more readily than older ones. It requires a comparatively large amount of the poison to cause any marked symptoms in an old cat.

After having made these experiments I received from Dr. R. C. Moffitt, of Lawton, Mich., the following letter:

"LAWTON, MICH., June 21, 1886.

"DEAR DOCTOR:—I understand from Prof. Chas. Lawton, of this place, that the cream sent to Lansing, for examination, has been forwarded to you, so I write to give you the particulars. About two hours after eating the cream every one was taken with severe vomiting, and after from one to six hours later with purging. The vomit was of a soapy character, and the stools watery and frothy. There was some griping of the stomach and abdomen, with severe occipital headache, excruciating back-ache and 'bone' pains all over, especially marked in the extremities. The vomiting lasted from two to three hours, then gradually subsided, and everybody felt stretchy, and yawned in spite of all resistance. The throats of all were œdematous. One or two were stupefied; others were cold and experienced some muscular spasms. A numb feeling, with dizziness and momentary loss of consciousness, was complained of by some. Temperature was normal, and pulse from 90 to 120. Tongue, dry and chapped. All were thirsty after the vomiting subsided, and called for cold water, which was allowed in small quantities, with no bad results. After getting out no one of the victims was able to be in the hot sun for several days, and even yet (about ten days after the poisoning) the heat affects myself. I attended twelve persons, besides being sick myself, and all were affected in pretty much the same way. Several complain yet of inability to retain food on the stomach without distressing them. The man who made the cream took a teaspoonful of it, and he vomited the same as those who ate a whole dish, but not so often nor for so long a time. All are affected with an irresistible desire to sleep, which can scarcely be overcome. Even yet, some of us feel that drowsy condition, with occasional occipital headache. Yours fraternally,

"R. C. MOFFITT, M. D."

It will be seen from the above that the symptoms produced in the persons agree closely with those observed in the cat. Cases of poisoning from ice-cream are by no means rare, and I hope that those who have the opportunity will not fail to test for tyrotoxicon. In the report of the Brooklyn Board of Health for 1885, an instance is given of the poisoning of more than 100 persons from ice-cream, sent out from one restaurant. The chemist was unable to detect any mineral poison. The injurious results were attributed to the use of decomposed gelatin; but no gelatin of any kind was used in the Lawton cream. Other cases occurring in New York and Brooklyn have been attributed to the employment of artificially prepared vanilline for flavoring; but the vanilla extract used in the Lawton cream was not poisonous, as has been shown.

As I write this, I notice in the daily papers, the report of the fearful poisoning from ice-cream, near Leamington, N. J. The papers state that the poisonous substance is arsenic, but how this has been determined is not given. I suppose that arsenic has been named from the symptoms. If it be true that the cream was made from milk brought in by the quart or gallon, by those participating in the festivities, the chance of mixing some milk containing the germ, which must produce the poison, with the good, and thus contaminating the whole, was as favorable as it could well be. Of course, if a chemical analysis shows the presence of arsenic, the question is settled; but in all similar instances chemical analysis has demonstrated the absence of mineral poisons.

The circumstances under which tyrotoxicon develops require further study. As has been shown above it may develop in normal milk, kept in a clean bottle for three months; but it is evident that in some instances it appears much earlier. The production of the ptomaine is, in all probability, due either directly or indirectly, to the growth of some micro-organism. In the cheese Dr. Sternberg found a new micrococcus; but whether or not there is any rela-

tion between this organism and the poison remains to be determined. In the cheese, milk, and cream, in all of which I have found the poison, there was present more or less butyric acid, and it may be that there is some intimate relation between butyric acid fermentation and the production of the poison. Some years ago Selmi obtained a ptomaine which resembles coniine, and pointed out that it might be formed by the action of butyric acid on ammonia, thus: $2C_4H_8O_2 + NH_3 - 2H_2O = C_8H_{15}N$.
(Butyric Acid.) (Ammonia.) (Coniine.)
or thus: $2C_4H_8O_2 + NH_3 + 2H - 4H_2O = C_8H_{15}N$.

In like manner other fatty acids may react with decomposing nitrogenous substances, forming alkaloidal bodies. Tyrotoxicon has no special resemblance, so far as is known, with coniine, but the possibility of these alkaloidal substances being formed in this way is worthy of mention. T. Lauder Brunton, in referring to the writer's discovery of tyrotoxicon, states that from the action of the substance he would infer the presence of two poisons. This is altogether possible. The writer has not been able to obtain the poison, as yet, in quantities sufficient to enable him to make an ultimate analysis of it. But that it is a chemical body produced by fermentation there can be no doubt.

If there be any doubt about the poison being produced by fermentation, the following experiment would seem to clear it up.

June 26, I took two samples, of one pint each, from a bottle of milk which had already undergone the lactic acid fermentation. These samples were placed in clean glass graduates. To one, a piece of the solid portion of the poisonous custard, about the size of a filbert, and which had been washed with distilled water, was added. To the other no addition was made. These samples stood side by side for forty-eight hours. Both were then tested for tyrotoxicon. The one to which no addition was made gave no crystals, no odor, and when given to a cat produced no effect. The one to which the addition had been made yielded crystals which had the odor of tyrotoxicon, and which, when given to a very large old cat, produced frothing at the mouth and retching, but no vomiting or diarrhœa, and the next day the animal was able to eat food and seemed to have recovered. I am quite certain that had this been administered to a young animal the result would have been more marked.

It is well known that milk, while undergoing the lactic acid fermentation, does not possess any such poisonous properties as those belonging to tyrotoxicon. There is no evidence, then, that the poison is connected in any way with the ordinary decomposition of milk. The following extracts from a letter just received from the maker of the Lawton cream shows that the attention given to the milk and vessels was all that could be desired:

"The milk of which the cream was made was fresh and sweet morning's milk, only reserving with it the cream of the milk of the night before from the same cows. The milk is kept in a cool, clean milk cellar. The custard was made about noon that day and immediately afterwards the process of freezing was begun. The vessels were all thoroughly cleaned. There was no possibility of any impurities adhering to them, for they were scalded, wiped and dried before being used. The only ingredients used were the milk, cream, eggs, sugar (best granulated) and the flavoring.

"The lemon cream was frozen first, then taken out, put into the packers, and packed solid wit ice and salt. Then the vanilla cream was frozen in the same manner. I used the best Jennings's extract, about the usual quantity, not in excess. The cream was eaten in the evening by many people of the village. All of those who ate of the vanilla cream were made sick, and none of those who ate of the lemon cream suffered any inconvenience.

"Now, the milk was the same in both, milked from the same cows the same morning that the cream was made, so that there was no difference in the custard used in making the vanilla cream and the lemon cream, but it turned out that the one made people sick and the other did not.

"We have continued making cream since in the same manner without the least change of the ingredients or the apparatus, except we have not used vanilla extract, but lemon and pine-apple, and it has been freely eaten and no one has been made sick by it.

"Clearly in my mind the milk does not account for the trouble. One thing further: of course the cream which you examined has been made since the ninth day of June, and may have undergone changes which would result in generating the poison referred to in the papers [certain newspaper accounts of the finding of the poison], and which would not have been found in the cream had it been examined when fresh.

"If there is anything farther that I can furnish you in regard to facts or circumstances in connection with this ice-cream, I will be willing at any and all times to give the fullest information possible. Hoping to receive the correct analysis soon, I remain yours respectfully,

"J. W. JOHNSON."

That the poison which I found in the cream was the same as that which affected the people can not be doubted after comparing the symptoms produced in the cat with those observed by Dr. Moffitt, and as has been stated the experiment on the cat was made before I received the letter from Dr. Moffitt. The cream was made on the 9th of June, and the poison separated on the 14th.

I wrote to Mr. Johnson asking several questions, which he has kindly and fully answered. As the nature of the questions is shown in the answers, I will simply give the answers:

"(1.) The milk from all the cows was mixed together in the making of the custard."

"(2.) The custard for the lemon and vanilla was all one custard; made and mixed before the extracts were put in."

"(3.) We had previously used the same brands of extracts (Jennings's best), both lemon and vanilla, with no bad results."

"(4.) The food of the cows in the morning and evening consists of oats and corn, ground together and fed dry, with clover hay. I have never seen anything suspicious in the pasture or food. There is a running stream of water, coming from a spring, in the pasture. There is plenty of shade. At evening the cows are driven from the pasture and placed in the stable or yard, according to the season. The stable and yard are open for inspection at any time. My residence is in the center of the village, and the board of health would not allow me to stable and yard my cows there if there were any bad odors during the summer."

"(6.) The teats are thoroughly washed before each milking."

After receiving the above details concerning the making of the cream, the following experiment was made:

July 8. To one quart of night's milk a piece of the solid portion of the Lawton cream, about the size of a filbert, was added. This residue had been left in the filter paper ever since the analysis of the poisonous cream, June 14, and it was on June 8 that the first milk for the preparation of the Lawton cream was collected. This dried and hardened lump was crumbled into the milk, which was placed in a clean tin pan and set in a cool cellar. July 9, to a quart of morning's milk, another small bit of the infected material was added, and this milk was also placed in the cellar. At 1 P. M. both portions of milk were poured into a clean earthenware jar, and four fresh eggs beaten and one pint of granulated sugar were added. The whole was thoroughly agitated, then allowed to stand at the temperature of the room until 4 P. M., when it was placed in the ice-box of a refrigerator, surrounded by ice and here kept until 7 A. M., the next morning, July 10. Then three ounces of the custard were stirred up with distilled water, filtered, the filtrate rendered alkaline and agitated with ether. The residue on the evaporation of the ether was dissolved in a little water and given to a kitten about two months old. Immediately the kitten manifested the symptoms of poisoning by tyrotoxicon, which have already been described. I began the analysis of this custard in the morn-

ing before having my breakfast, and getting a little on my finger in carrying the jar, I tasted of it. Within a very few minutes I was nauseated, and ten minutes after taking it I vomited. The prompt action of so small a quantity was probably due to the condition of my stomach. At 2 P. M. of the same day I took one teaspoonful of the custard. Within thirty minutes there was marked nausea and some violent retching, but no vomiting. At 3 P. M. the symptoms having abated, I took a tablespoonful more of the custard. At about 3 : 30, I began to vomit freely. The nausea continued for about an hour. After this there would be passing sensations of sickness. At 8 P. M , while visiting a patient, I was taken very suddenly and sharply with nausea and griping pains in the abdomen. I again vomited and had one watery stool. After this there was no farther trouble. The occipital headache, mentioned by Dr. Moffitt in his letter, was very marked for some hours after taking the custard. It consisted of sharp, lancinating pains which were confined wholly to the occiput. The nausea was peculiar. I cannot say that there was pain in the stomach. A sickening taste would be felt in the mouth and a peculiar, very sickening odor, which I recognized as that of the isolated poison, would intensify the nausea. The throat and mouth seemed filled with a sticky, tenacious mucus. In short, the effects on these parts resembled those which I have experienced from an over-dose of atropia.

I think that this experiment explains the poisonous nature of the vanilla cream. The fermentation going on in the custard, and probably begun in the milk, was arrested in that part flavored with lemon by the freezing which was begun immediately. But while the lemon cream was being frozen that part of the custard which was to be made into vanilla cream continued to ferment, and before the freezing process was begun enough of the poison was generated to seriously affect those eating of it.

It should be remarked that in the custard which I made there was nothing peculiar in the taste. It was sweet and pleasant. But while it was not at all acid to the taste, it gave a decidedly acid reaction as tested by litmus, and was not amphoteric in reaction, as cow's milk frequently is.

It is possible that the presence of the large amount of albumen in the custard, from the eggs, hastened the fermentation. I believe that makers of cheese have found by experience that a large amount of albumen in cheese renders decomposition more easy.

How the special germ which produces the poison found its way into the Lawton cream I cannot say; but that it was either present in the milk or was contained in the eggs used, I think cannot now be doubted.

TYROTOXICON, AND CHOLERA INFANTUM.

I desire to call attention to the great similarity between symptoms of poisoning by tyrotoxicon, and those of cholera infantum. I am aware of the fact that the term "cholera infantum" is used by many in referring to almost any summer diarrhœa of children; but restricting the term to the violent choleraic diarrhœa, as is done by Smith and other best authorities on the subject, we shall find its similarity to poisoning by tyrotoxicon very marked.

The suddenness and violence of the attack, the nausea and vomiting without marked tenderness of the abdomen, the character of the stools, the great thirst, the severe pain in the back of the head, the nervous prostration, and the tendency to deep sleep, are all observed in both. Again, the white, soggy appearance of the mucous membrane of the stomach of the cat corresponds

exactly with observations in children after death from cholera infantum. Cholera infantum, as is stated by Smith, "is a disease of the summer months; and, with exceptional cases, of the cities." Thus, the disease occurs at a time when decomposition of milk takes place most readily. It occurs at places where absolutely fresh milk often cannot be obtained. It is most prevalent among classes of people whose surroundings are most favorable to fermentative changes. It is most certainly fatal at an age when there is the greatest dependence upon milk as a food, and when, on account of the rapid development of intestinal follicles, there is the greatest susceptibility to the action of an irritant poison, and when irritative and nervous fevers are most easily induced. If all these facts be taken into consideration, along with the experiments which have been detailed, and which show the readiness with which the poison can be generated, it will certainly seem at least probable to any one that tyrotoxicon may be a cause of cholera infantum. A little dried milk formed along the seam of a tin pail, or a rubber nipple, tube or nursing bottle not thoroughly cleansed, may be the means of generating, in a large quantity of milk, enough of the poison to render it highly harmful to children. The high temperature observed in children with cholera infantum, and which has not been observed in adults poisoned by tyrotoxicon, may be caused by the continued production of the poison in the child's intestine, by the continued administration of milk, and by the greater susceptibility of the sympathetic nervous system in children.

If this causal relation does exist between tyrotoxicon and cholera infantum, a knowledge of it will aid us, not only in the preventive, but in the curative, treatment of the disease. The first thing to do in the treatment of the disease is to absolutely prohibit the further administration of milk, either good or bad, because the fermentation going on in the intestine would simply be fed by the giving of more milk, even if that milk be of unquestionable purity. I would suggest that some meat or rice preparation be used for food, though experience will soon give us valuable information on this point.

A germ which forms a poisonous ptomaine by its growth in milk may be wholly harmless when placed in a meat or rice preparation.

Secondly, mild antacids should be administered, because the poison, so far as our information goes, is produced only in acid solutions. The great value of the chalk mixture in the treatment of the disease is well known.

Thirdly, theoretically at least, the employment of small doses of some disinfectant would be of benefit. I find that there is considerable difference of opinion in the profession as to the use of small doses of calomel in this disease.

Fourthly, the use of opium in some form is consistent with the theory.

And lastly, the administration of stimulants, brandy and ammonia, to counteract the depressing effects of the poison, already formed and absorbed, should be practiced.

All of these, save the first recommendation, have been practiced in the treatment of the disease empirically; but the first—absolute discontinuance of the use of milk—I regard as of prime importance.

Of course, it will be understood that attention to securing fresh air, and to other hygienic measures, is also desirable.

It is altogether probable that an amount of the poison which would escape chemical detection, might be sufficient to produce poisonous effects in children.

ANN ARBOR, July 12, 1886.

REPORT OF PROGRESS IN OUR KNOWLEDGE OF TYROTOXICON.*

BY VICTOR C. VAUGHAN, M. D., PH. D., ETC.

The most important contribution to our knowledge of this substance since my last report (proceedings of the Michigan State Board of Health, July 13, 1886) consists of the work of Dr. W. K. Newton and Mr. Shippen Wallace, analysts for the New Jersey State Board of Health. The report of their work has been published in the Philadelphia Medical News, September 25, 1886; but it is of so much importance that I herewith submit the following quotations from their article:—

"On August 7th twenty-four persons at one of the hotels at Long Branch were taken ill soon after supper. At another hotel, on the same evening, nineteen persons were seized with the same form of sickness. From one to four hours elapsed between the meal and the first symptoms. The symptoms noticed were those of gastro-intestinal irritation, similar to poisoning by any irritating material—that is, nausea, vomiting, cramps, and collapse; a few had diarrhœa. Dryness of the throat and a burning sensation in the œsophagus were prominent symptoms.

"While the cause of the sickness was being sought for, and one week after the first series of cases, thirty persons at another hotel were taken ill with precisely the same symptoms as noticed in the first outbreak.

"When the news of the outbreak was published one of us immediately set to work, under the authority of the State Board of Health, to ascertain the cause of the illness. The course of the investigation was about as follows:

"The character of the illness indicated, of course, that some article of food was the cause, and the first part of our task was to single out the one substance that seemed at fault. The cooking utensils were also suspected, because unclean copper vessels have often caused irritant poisoning. Articles of food, such as lobsters, crabs, blue fish, and Spanish mackerel, all of which at times, and with some persons very susceptible to gastric irritation, have produced toxic symptoms, were looked for, but it was found that none of these had been eaten at the time of the outbreak. The cooking vessels were examined, and all were found clean and bright and no evidence of corrosion was presented.

"Further inquiry revealed the fact that all who had been taken ill had used milk in greater or less quantities, and that persons who had not partaken of milk escaped entirely; corroborative of this it was ascertained that those who had used milk to the exclusion of all other food were violently ill. This was prominently noticed in the cases of infants fed from the bottle when nothing but uncooked milk was used. In one case an adult drank about a quart of the milk, and was almost immediately seized with violent vomiting followed by diarrhœa, and this by collapse. Suffice it to say that we were able to eliminate all other articles of food and to decide that the milk was the sole cause of the outbreak.

"Having been able to determine this, the next step was to discover why that article should, in these cases, cause so serious a form of sickness.

"The probable causes which we were to investigate were outlined as follows: (1) Some chemical substance such as borax, boric acid, salicylic acid, sodium bicarbonate, sodium sulphate, added to preserve the milk or to correct acidity. (2) The use of polluted water as an adulterant. (3) Some poisonous material accidentally present in the milk. (4) The use of milk from diseased cattle. (5) Improper feeding of the cattle. (6) The improper care of the milk. (7) The development in the milk of some ferment or ptomaine, such as tyrotoxicon.

"At the time of the first outbreak we were unable, unfortunately, to obtain any of the noxious milk, as that unconsumed had been destroyed, but at the second outbreak a liberal quantity was procured.

"It was soon ascertained that one dealer had supplied all the milk used at the three hotels where the cases of sickness had occurred; his name and address having been obtained, the next step in the investigation was to inspect all the farms, and the cattle thereon, from which the milk was taken. We also learned that two deliveries at the hotels were made daily, one in the morning and one in the evening; that the milk supplied at night was the sole cause of sickness, and that the milk from but one of the farms was at fault. The cows on this farm were found to be in good health, and, besides being at pasture, were well fed with bran, middlings, and corn-meal.

* Read at the meeting of the State Board of Health October 1, 1886.

"So far, we had been able to eliminate as causes diseased cattle and improper feeding, and we were then compelled to consider the other possible sources of the toxic material.

"While the inspection of the farms was being made, the analysis of the milk was in progress. The results of this showed that no chemical substance had been added to the milk, that it was of average composition, that no polluted water had been used as a diluent, and that no poisonous metals were present. This result left us nothing to consider but two probable causes: improper care of the milk, and the presence of a ferment.

"As to the former, we soon learned much. The cows were milked at the unusual and abnormal hours of midnight and noon, and the noon's milking—that which alone was followed by illness—was placed, while hot, in the cans, and then, without any attempt at cooling, carted eight miles during the warmest part of the day in a very hot month.

"This practice seemed to us sufficient to make the milk unpalatable, if not injurious, for it is well known that when fresh milk is closed up in a tight vessel and then deposited in a warm place, a very disagreeable odor and taste are developed. Old dairymen speak of the 'animal heat' as an entity, the removal of which is necessary in order that the milk shall keep well and have a pleasant taste. While we do not give this thing a name, we are fully convinced that milk should be thoroughly 'cured' by proper chilling and aeration, before it is transported any distance or sold for consumption in towns or cities.

"This opinion is based on a study of the methods prevalent among experienced dairymen, who ship large quantities of milk to our great cities. The usual practice is to allow the milk to stand in open vessels, surrounded by ice or cold water, for from eight to twelve hours before transportation, and when placed on the cars it has a temperature of from 50° to 60°, and is delivered to the consumers in a perfectly sweet condition. The city of New York receives about 200,000 gallons each day from the surrounding country, and much of it brought in by the railroads has been on the cars for a time varying from six to twelve hours, yet we seldom hear of any of this milk undergoing the peculiar form of fermentation set up in the Long Branch milk. We may account for this by assuming that the proper care of the milk after it was taken from the cow, and the low temperature at which it was kept, have prevented the formation of any ferment; this opinion seems to be endorsed by all dairymen and managers of large creameries with whom we have consulted. They all agree in stating that milk maintained at a low temperature can be kept sweet and in good condition for many days.

"We have dwelt on this branch of our topic somewhat extensively, because we are fully persuaded that the improper care of the milk had much to do with the illness it produced.

"The results of our inquiry having revealed so much, we next attempted to isolate some substance from the poisonous milk, in order that the proof might be more evident. A quantity of the milk that had caused sickness in the second outbreak was allowed to coagulate, was then thrown on a coarse filter, and the filtrate collected. This latter was highly acid, and was made slightly alkaline by the addition of potassium hydrate. This alkaline filtrate was now agitated with an equal volume of pure, dry ether, and allowed to stand for several hours, when the ethereal layer was drawn off by means of a pipette. Fresh ether was added to the residuum, then agitated, and, when separated, was drawn off and added to the first ethereal extract. This was now allowed to evaporate spontaneously, and the residue, which seemed to contain a small amount of fat, was treated with distilled water and filtered, the filtrate treated with ether, the ethereal solution drawn off and allowed to evaporate, when we obtained a mass of needle-shaped crystals. This crystalline substance gave a blue color with potassium ferricyanide and ferric chloride, and reduced iodic acid. The crystals, when placed on the tongue, gave a burning sensation. A portion of the crystals was mixed with milk and fed to a cat, when, in the course of half an hour, the animal was seized with retching and vomiting, and was soon in a condition of collapse, from which it recovered in a few hours.

"*Conclusions.*—We are justified in assuming, after weighing well all the facts ascertained in the investigation, that the sickness at Long Branch was caused by poisonous milk, and that the toxic material was tyrotoxicon.

"The production of this substance was no doubt due to the improper management of the milk—that is, too long a time was allowed to elapse between the milking and the cooling of the milk; the latter not being attended to until the milk was delivered to the hotel; whereas, if the milk had been cooled immediately after it was drawn from the cows, fermentation would not have ensued, and the resulting material, tyrotoxicon, would not have been produced."

Prof. C. B. Gibson, of Chicago, has shown the absurdity of the claim that the vanilla of ice cream is the active poisonous agent, inasmuch as he calculates, from the amount of flavoring ordinarily used in ice cream, that in order to produce the toxic symptoms observed the extract of vanilla must be ten times as poisonous as strychnia (Medical Record, August 28, 1886). This, taken with the facts given in my last report to this Board, should be

proof sufficient that the vanilla used in the Lawton cream was not poisonous.

Prof. J. S. Welford, of Richmond, Va., has observed several cases of poisoning from custard flavored with lemon. Prof. W. eliminated all possibility of the poisoning being due to mineral poisons or to the lemon. As these observations were made before the discovery of tyrotoxicon, this substance was not tested for.

RELATION OF TYROTOXICON TO CHOLERA INFANTUM.

Since my last report I have found tyrotoxicon in one sample of milk. As this case has a direct bearing on the probable relationship between tyrotoxicon and cholera infantum, I will report it somewhat in detail.

July 30, 1886, about 1 o'clock P.M., I was called to see the seven months' old babe of Mr. B. I found that the child had been vomiting quite constantly for some three hours. It had also passed watery stools some six or seven times. The eyes were sunken, skin cold and clammy, and pulse rapid and small. I diagnosed cholera infantum. During the preceding night, the child had seemed as well as usual, and had taken nourishment freely from the mother's breast. Early in the morning it had been given a bottle of cow's milk, and soon thereafter the nausea and vomiting began. Later, as stated above, the child began to purge. The mother, furnishing an insufficient supply of milk, it had been the habit to give the child cow's milk several times during the day. I prohibited the further use of milk, both that from the mother and from the bottle, and substituted meat preparations and rice water as foods. I also prescribed pepsin, bismuth subnitrate, chalk mixture, and camphorated tincture of opium.

The cow's milk which had been furnished the child was from an animal kept by one of the neighbors. On the evening of the same day that the child was taken sick I obtained two quarts of the morning's milk of this animal. The milk had the appearance of very rich cream, being of a yellow tint throughout. This milk was allowed to stand through the night of the 30th in the ice-box of a refrigerator. On the morning of the 31st I began the analysis. After pouring the milk from the pitcher there remained in that vessel about two ounces of a fluid the color of port wine. Microscopical examination of this fluid showed the presence of pus and blood corpuscles. The blood was also detected by obtaining the characteristic bands of oxyhemoglobine with the spectroscope. The milk, which had already coagulated, was filtered. The strongly acid filtrate was rendered feebly alkaline with potassium hydrate and then agitated with absolute ether. After separation the ether was removed with a pipette and allowed to evaporate spontaneously. This residue was dissolved in distilled water and again agitated with ether. This ethereal solution left, after spontaneous evaporation, a residue which had a slightly brownish tint. I did not obtain the crystals of tyrotoxicon, doubtlessly owing to this trace of impurity; but the residue had the odor and taste of tyrotoxicon. This residue dissolved in some distilled water and given to a cat produced retching and vomiting.

That tyrotoxicon was present in the milk taken by the child shortly before the beginning of its illness there could now be no doubt. It is true that the milk was abnormal in other respects also, inasmuch as it contained pus and blood.

After the withdrawal of all milk and the use of the medicinal agents men-

tioned above, the child began to improve, and by the afternoon of August 1 it seemed so well that it was allowed a bottle of good cow's milk (from another animal); but soon after taking this milk it again began to vomit and purge. Milk was again withheld and the same medicinal treatment resorted to. This attack was slight, and after it the child continued to improve until the night of August 4, when the grandmother, who "knew more about raising babies than the doctor," fed the child bountifully upon milk. Again the vomiting and purging began, and it was more than a week before all symptoms of gastro-intestinal irritation had disappeared. About the 15th of August milk was again allowed, at first in small quantity, and this seeming to have no harmful effect, more liberal quantities were given. The child has continued well since.

From the above observed facts I infer that not only the poison but the ferment, by whose growth the poison is generated, was introduced into the alimentary canal, that this micro-organism continued to live until some time after August 4, and when the milk was given the poison was again formed by the growth of the ferment. Whether or not any germicide could have been borne by the child in sufficient quantity to destroy the ferment I do not know.

It now remains to ascertain with certainty the nature of the ferment concerned in the production of tyrotoxicon, and to determine by experiments upon milk inoculated with this germ the value of various germicides. Many physicians claim that the bichloride of mercury in proper doses is a very valuable agent in the treatment of cholera infantum.

Fortunately no other children were furnished with the milk of this cow which first supplied the B. baby. The attention of the owner of the cow was called to the nature of the milk, and its use by all was discontinued for some days. There was no sore visible upon the teats. Had this milk been mixed with that of a number of other animals the color would have escaped detection, and all the milk might have been rendered poisonous.

ANN ARBOR, October 1, 1886.

Note.—Since the above was written, Dr. C. S. Allaben, of Gilbertsville, N. Y., has reported some interesting facts concerning ice-cream poisoning. July 6, 1886, some seventy-five persons were poisoned at a church festival, and manifested the symptoms described by Dr. Moffit in my first report to this Board. It seems that no analysis of the cream was made, but the fact that the cream was flavored with lemon, and the conditions under which the cream was prepared are of interest. Concerning the making of the cream Dr. Allaben writes as follows:

"I would first say July 4, 5, and 6, were very warm. Monday evening, July 5, the custards were cooked, made from Monday morning's cream and Monday night's milk, boiled in a tin pan that had the bright tin worn off. It was noticed that one pan of cream was *not sweet*, but thinking it would make no difference, it was used; the freezers were thoroughly cleaned and scalded and the custards put in the same evening while hot; the cream was frozen Tuesday afternoon, *having stood in the freezers since the night before*, when the weather was very warm **." Dr. Allaben's paper will be found in *The Medical Record*, October 9th, 1886.

Professor Shearer, chemist to the Iowa State Board of Health, has recently isolated by my method tyrotoxicon from samples of milk which caused sickness at Corning, Iowa. He also isolated the poison from the vomited matter of those sick.—See Professor Shearer's report to the Board in the Iowa State Register, October 12, 1886. V. C. VAUGHAN.

AMERICAN MEDICAL ASSOCIATION.

REPORT OF PUBLIC HEALTH WORK AT MEETING IN ST. LOUIS, MO., MAY 4-7, 1886.

BY ARTHUR HAZLEWOOD, M. D., MEMBER OF THE MICHIGAN STATE BOARD OF HEALTH.

To the Michigan State Board of Health:—

GENTLEMEN,—As your delegate to the American Medical Association, I was in attendance at the opening session, and listened with much pleasure to the President's address. The subject matter was largely historical, and a resumé of the same is not admissible at this time—being foreign to the duties of this Board as health guardians. It is, however, proper to recall the statement made, that "The prevention of yellow fever, the scourge of the Gulf States, is a problem in which our whole country is interested. Dr. Joseph Holt, of New Orleans, President of the State Board of Health of Louisiana, has given much time and study to the question. A bill has been reported to the House of Representatives at Washington, appropriating money to investigate whether it can be averted and even prevented." He followed with a suggestion, that a proper resolution adopted by the association would have great weight with Congress, and claimed that such investigation should be conducted at the expense of the general government.

In consequence of the small number in attendance upon the Section on State Medicine the first day, it was determined to postpone the section until the next day. This gave me an opportunity to attend the Section on Obstetrics, etc., where I heard a gentleman make the statement that he attended two abortions to one case of full term utero gestation. Though the gentleman's practice doubtless is exceptional, it is a sad comment either on the moral or physical degeneration of the women.

The next day the Section on State Medicine held a session, the first paper being entitled a "New Method of Life Assurance," by Wards Hutchinson, A. M., M. D., Iowa. The writer advocated a system of contracts between physicians and patients, and embracing not only medical attendance when sick, but a sanitary supervision of the household; no new method of doing the work, but simply a different financial relation.

Dr. G. S. Franklin, Ohio, then read a paper advocating purification and destruction of debris, excretions, etc., in small furnaces, quoting largely

from Leviticus as showing the understanding of the necessity of such sanitary precaution during the Mosaic dispensation.

In the general session the third day, Dr. Kellar read a paper on Cremation, which embodied a resolution to the effect that cremation was now a sanitary measure needful to be observed in most large cities wherever practicable.

This resolution, by amendments and parliamentary fussing, was at last passed as the previous question, and followed by a reconsideration. Then it was referred to the section on State Medicine. During the afternoon it was discussed pro and con, but with considerable opposition. Finally the paper of Dr. Kellar was referred to the publishing committee for publication, and a reference to the general session asking for a committee to ascertain the facts in the matter.

A paper on the Hygiene of Periodic Fevers followed, but so far as I could gather, the writer, although treating the subject at length, presented no new methods.

In accordance with a resolution adopted in the general session, the section on State Medicine nominated its own officers, choosing Dr. Geo. H. Rohé, of Baltimore, for chairman, and Dr. Wyman, of the Marine Hospital service, as secretary.

The report of the chairman of the Section of State Medicine was very long, and began with reference to the idea conveyed by the term State Medicine, and its many definitions, formulating it finally as "that branch of science which relates to the prevention, cure or alleviation of the diseases of the human body." The main part of his address was a history of State regulation of medical practice and medical education. Then followed some allusions to the work of municipal and State boards, also to the proceedings of the various organizations, such as the American Public Health Association and others. His report on the different theories advocated as to bacteria, and the causation of diseases, promulgated during the year, is that they are one and all *sub judice.*

He finished his report with an account of vaccination, wherein he took the ground that bovine virus is not so reliable as humanized, giving the experience in Germany and in England as to the frequent failure of bovine virus to protect after exposure to small-pox, and of the almost always successful results where humanized lymph was used, quoting "In cases of emergency, where promptness of action is important, the preference must be given to the humanized."

Respectfully submitted.

A. HAZLEWOOD.

REPORT OF COMMITTEE TO INVESTIGATE AN ALLEGED NUISANCE AT NEGAUNEE.

To the State Board of Health:

GENTLEMEN,—In compliance with a request from Dr. Lombard, health officer of the city of Negaunee, Drs. Baker and Avery were appointed a committee from this Board to visit that city and investigate an alleged nuisance affecting its water-supply. Accordingly your committee visited that city on the twenty-ninth day of July. We found a beautiful city of about 5,000 inhabitants nestling among the iron hills of Marquette county, and located near a fine sheet of water of about 600 acres in area. This lake appears to be fed by underground springs. The city's water-works are situated on its border at a point nearest the town, and about 600 yards from the outlet. At the time of the visit of your committee, not more water than would pass through a two-inch pipe with an incline of one inch to the rod, was running in the outlet, while at the works there was being pumped about 600,000 gallons per day, practically making the outlet of the lake at the water-works. Midway between the natural outlet and the water-works, and on the border of the lake, is situated a slaughter-house, where the principal part of the slaughtering for the city is done. A few rods nearer the water-works is another house where some slaughtering is done. Both of these places drain directly into the lake at some seasons, and through a small quantity of sand at other times; and the houses and their surroundings were as filthy as they could well be made. The stench in and around them was simply unbearable. In the larger house there was a large pile of heads, the accumulation of two or three weeks' killing, and in various stages of decomposition. In another corner was a stack of salted hides. On and under the floor was decomposed and decomposing blood; and outside the building, wagon loads of refuse and offal rotting and stinking. In this building dressed meat was allowed to hang from evening till morning. Just outside this building was a large mud hole, which at the time of our visit was being filled up. The proprietor of this place owned some fifteen acres of land on the border of the lake, and had his slaughter-house located near its present site long before the city erected its water-works. He had moved his house once at the request of the city authorities, and now refused to move it again. In the lake, on the side of the water-works opposite to the slaughter-houses, a small quantity of logs is annually boomed for the convenience of a mill near by. The supply pipe at the water-works extends into the lake only about 80 feet. Having ascertained the condition of affairs, your committee met the health officer, mayor, and proprietor of the slaughter-house in consultation. After a few moments talk intended to allay the existing antagonism between the parties, your committee recommended as follows:—

1. That the water supply pipe be extended into the lake at least 500 feet.

2. That the slaughter house be moved to a point agreed upon by your committee after consultation with the proprietor, health officer, and mayor, and away from the lake.

3. That the city should pay the expense of such removal.

These recommendations were promptly and cheerfully accepted by both parties, who each agreed to carry them out in good faith; and as evidence that this is being done we append the following extract from a letter received a few days since from Dr. C. S. Lombard:

"Since your brief visit to our town, Mr. Winter has immediately proceeded to erect a new slaughter-house upon the ground selected by you; and I anticipate smooth sailing from this on. Your visit had the desired effect, and kept us out of litigation. * * * Nor is this all. I feel, and several have expressed the belief, that the precedent established will work a great good throughout the county, for Negaunee is not the only city afflicted with filth; and our near neighbors will no doubt profit by the example now set them."

All of which is respectfully submitted.

JNO. AVERY,
HENRY B. BAKER,
Committee.

NORTHERN ASYLUM FOR INSANE.

REPORT OF COMMITTEE ON ITS SANITARY CONDITION.

To the Michigan State Board of Health:

GENTLEMEN,—You committee appointed to visit certain State institutions, and learn their sanitary condition, and to what extent recommendations by this Board have been accepted and carried out, respectfully report relative to the NORTHERN ASYLUM FOR THE INSANE, AT TRAVERSE CITY, as follows:

July 27, 1886, we inspected that institution, our work being facilitated by the medical superintendent, James D. Munson, M. D., and by Mr. Goode, the steward of the Asylum. The grounds about the building were being graded. We found the asylum in an excellent sanitary condition.

THE WATER-SUPPLY.

All water used is from a well in the rear of the building, and which is about fifty feet deep. It is about 16 feet in diameter at the bottom, less at the top. It contained water about twenty feet in depth. The water is hard. The well is walled with brick laid in water-lime from top to bottom. The area of ground the rain falls upon which supplies the large amount of water used is undoubtedly large. It is quite probable that if the discharges from a single person suffering from typhoid fever were to be placed on the ground where they could filter through the gravel into the well a serious outbreak of typhoid fever might occur among those who use the water; but undoubtedly that danger will be constantly guarded against. No privy or other receptacle for human excrement was seen about the premises; and the superintendent said that care was taken that no dangerous substance shall leech down into the soil near the well. Suitable water-closets, connected with the sewer-system, are available for all classes of inmates of the asylum.

THE DISPOSAL OF SEWAGE.

In accordance with the recommendation of this Board (page 178, Annual Report for 1885) the sewage is "conveyed in the water-tight conduit to the Boardman river."

THE VENTILATION OF THE CHAPEL BUILDING.

The suggestion by this Board (page 178, Report for 1885) relative to provision for larger inlet space for fresh air into the chapel building was not

adopted literally; but the eight openings to the outer air, before which were to be placed the radiators—so as to make the method of heating "direct-indirect"—were made of a larger size than "6 by 12 inches," "diminished by a register on the inside, so that the opening is about 4 by 12." It was difficult to measure just how large these openings behind and under the radiators are, but they are stated to be 10 by 12 inches, reduced by about one-fifth by the open register; and if so are somewhat larger than was the plan this Board thought too small. The recommendation of this Board (page 179, Report for 1885) as to additional foul air shaft "having a sectional area of not less than 12 square feet," has been adopted. The superintendent and the steward said no difficulty had been experienced in warming the chapel, and no lack of ventilation had been observed by the unaided senses. The opening (about 648 square inches) into the garret near the center of the ceiling had not been closed. Mr. C. M. Wells, building superintendent, says: "The attic above the chapel room has two ventilating turrets, each having an area of two feet six inches by two feet six inches. The circular opening at the ceiling of the chapel room will be connected directly to one of these turrets, and the flues leading from the base of the stage in the chapel room will be connected with the other. An exhaust ventilating fan has been purchased, and will shortly be put in place for conveying air from the chapel room by power."

VENTILATION OF THE MAIN BUILDING.

In accordance with a recommendation of this Board (page 179, Report for 1885) an additional turret for ventilation was being put in over that portion of the building known as "B transverse," and also one over the corresponding portion known as "2 South." The horizontal trunks along the floor of the garret had not all been connected with the openings through the roof; but we were assured that it would be done soon. The fan was not yet in operation; and some difficulty had been experienced in warming a portion of the front of the central building, apparently because not sufficient air entered. It is hoped, however, that when the large fan is in place this difficulty may be overcome. If it is not, fresh air may be admitted to that part of the building through a tunnel, from some distance in front of the building.

VENTILATION OF WATER-CLOSETS.

Relative to the recommendation by this Board (first paragraph on page 180, Report for 1885) the ventilators had to remain on opposite side of the room from the closet bowl, in some instances, because in the wall on the same side there was not sufficient room to admit the ventilating flue.

HENRY B. BAKER,
JNO. AVERY.

REPORT OF THE EXAMINATION OF THE MONTCALM COUNTY JAIL AT STANTON, MICHIGAN.

BY JOHN H. KELLOGG, M. D., MEMBER OF THE STATE BOARD OF HEALTH, BATTLE CREEK, MICH.

By request of Dr. John Avery, the president of this board, I visited the Montcalm county jail and court house at Stanton, Mich., for the purpose of making a sanitary inspection of the building and premises, in accordance with an action of the county board of supervisors requesting that such an inspection be made. I expected to meet Dr. Avery, and to be assisted by him in the inspection, but as he was unable to meet me as he anticipated, I proceeded to make the inspection alone, and hereby submit the following report, a copy of which, with the exception of one or two unimportant additions, was presented to the board of supervisors by Dr. Avery at the next meeting following the inspection:

To the Board of Supervisors of Montcalm County:

GENTLEMEN:—At your request, communicated to me through Dr. J. Avery of your board, and in company with your committee and the sheriff and the treasurer of your county, I visited your county court house and jail and made a sanitary inspection of the building and premises, a report of which I hereby respectfully submit. I regretted very much the absence of Dr. Avery, who was unavoidably detained from being present, but from conversation with him since the inspection I have reason to believe that he fully coincides with me in the opinions expressed and the recommendations made in this report, and which I trust may be found worthy of your careful consideration and approval.

Your personal familiarity with the building and premises inspected renders a lengthy description unnecessary. I will call attention to the following points only:—

1. The location of the building upon the highest point of land within the limits of the town, an eminence, the foot of which is surrounded by private residences. The soil very porous in character for many feet in depth, overlying an impervious layer which retains above it a varying amount of ground water, the chief source of water supply in some parts of the town.

2. The structure of the building: two stories and a basement, the latter occupied on one side by the jail and the other by the apartments for the jailer's family. The first story is used for county offices and the second for court room. The two features of the building to which special attention was directed, and which were found most open to criticism, were the ventilation and the sewerage. In both of those particulars I think I may justly say that the condition of the building and premises of Montcalm county court house are extremely bad, and in need of most prompt and thoroughgoing reformation.

First, as regards the ventilation; there has been in the construction of the building a commendable attempt to supply a system of ventilation which doubtless, in the opinion of the builders, was ample and efficient, but which is, in its practical working, liable to entail the most serious consequences, and upon the whole, really worse than dependence upon windows and doors for the necessary change of air. Little or no attempt has been made to supply fresh air otherwise than through open windows or doors, but several shafts and ducts have been provided for the removal of foul air, the largest of which, a shaft about 6 x 6 feet, in sectional area, surrounds the furnace smokestack, an economical and commendable arrangement, as it provides for a regular heating of the shaft, thus securing a draft in it whenever the weather is such as to require the building to be closed and heated. This large shaft extends from the basement to the roof, and is connected by register openings with the male and female departments of the jail, several of the county offices and the court room; some of the jailer's apartments have separate ventilating shafts which are also connected with those of the county offices, which are located directly above these rooms. It thus appears that the three stories of the building are connected to the one large ventilating shaft, and the first story and the basement share the large and the smaller ventilating shafts in common. Let us briefly note the evils which arise from this arrangement.

Beginning at the bottom, we observe that the ventilating shaft is located between the male and the female departments, each of which communicates with it by a register. In the male department, the register is placed close by the water closet and urinal, which, from the defective condition of the sewer, and the absence of a urinal, were in a very foul state constantly, giving off offensive gases, sometimes to an extent to render the stench absolutely intolerable. When the draft in the ventilating shaft happens to be strong, these vile odors are carried away ; but when the draft is deficient, or when it is reversed, they are driven into and dispersed through the room. Sometimes, when the wind happens to be in a southerly or easterly direction, and a window open in the male corridor, the foul odors from the male side are driven across the ventilating shaft and out into the female corridor, and vice versa. A very forcible illustration of the evils which may grow out of this arrangement was afforded at the time of the inspection. When first examined, the register on the male side of the ventilating shaft was found to be affording egress to a considerable amount of foul air; but when tested a half hour later, it was found that the current was in an opposite direction; that is, there was a current of air passing out from the ventilating shaft into the male corridor. And where did this air come from? At the time in question, there were no females in the jail, and the female corridor was in use as a hospital, being occupied by a man sick with malignant diphtheria. The case had

been so bad that the doctor in attendance had entertained small hope of the patient's recovery. The throat was still in a sloughing condition, and the odor characteristic of the disease in such cases was present in a very marked degree. A window had been open wide to allow of free ventilation; and as the window happened to be located on the side of the room toward the wind it afforded entrance to a strong current of air, which passed into the ventilating shaft through the register, and, passing across the shaft, passed out at the register on the male side of the shaft. The jail physician had placed the patient in the female corridor for the purpose of protecting the rest of the prisoners from the danger of contracting the disease, which was very proper action, but the ventilating arrangements which I have described, and which were not known or understood by the physician, rendered his efforts to quarantine the patient not only useless, but worse than useless. It is quite probable that there would have been less general exposure of the prisoners to the contagion of the disease if the patient had been allowed to remain in the corridor with the rest; certainly a more ingenious device for spreading contagious maladies could not be invented.

Ascending the second story, we found the offices of the treasurer and the other county officers connected to the same shaft and exposed to the same danger of infection from disease, to say nothing of the constant necessity of breathing air which had been breathed over and over by the prisoners below and then passed up the ventilating shaft and out into the rooms, whenever the wind and the windows happened to be in the right relation to each other. The treasurer complained that the stench is often so overpowering that he was sickened by it, and that he had sometimes been actually driven out of his office. Wholly unconscious of the danger to which he was exposing himself and his family of small children by the daily exposure to an atmosphere charged with the contagion of a virulent disease, he inquired if I thought there was any danger that he would contract the disease. I had no hesitancy in expressing an opinion upon the subject.

Ascending to the third floor, we find the commodious court room communicating with the same shaft by a large register. When first tested, the ventilation seemed to be working very satisfactorily, but it was only necessary to close one window and open another on the opposite side of the room to reverse the current and bring out into the room a volume of germ-laden air so vile and sickening in character that the members of the committee were glad to seek a safe distance without delay. Imagine a court room, filled with people of all ages, exposed to such an active agent of death and disease as this.

No further argument was necessary to convince all present of the pressing need of a reform of the ventilating system in use in the building. All other ventilating shafts were found to be operating in precisely the same manner. The clerks in some of the offices were in the habit of closing the ventilating registers a great part of the time and depending upon the windows for ventilators, on account of the foul air escaping from the registers.

Second, as regards the sewerage: The present system consists of a sewer laid upon the ground beneath the basement floor by which the sewage is conveyed to a cess-pool in the rear of the building. The sewer is constructed of tile loosely laid together with little or no cement. Many of the tile have been broken and have not been repaired. The poor construction of the sewer has led to frequent stoppages between the closets and the cess-pools at

points under the building difficult of access. To relieve these obstructions when they occur a man crawls under the building upon his hands and knees and breaks a hole in the pipes at different points until the pent up sewage gushes out upon the ground and the obstructing matter is removed. Many such holes have been made, and instead of being repaired have been loosely covered or stopped with bricks. As the result of these frequent openings a large amount of decomposing sewage has accumulated upon the ground under the jail. The exact amount is not known, but the sheriff estimated it to be several wagon loads.

The sheriff complained that the odors in the apartments occupied by his family were often almost unendurable. Certain rooms were often uninhabitable for weeks at a time. Often the intensity of the odors in those rooms most favorably located was so great as to produce distressing nausea on awaking in the morning. He stated that his daughter, a young lady, had declined in health to such a degree that consumption or a fatal decline was feared. She was on this account sent away, and at once began to improve, and in a few weeks was quite restored to health.

It is worthy of notice that the prisoner who was suffering with diphtheria had been in the prison a month, and most likely contracted his disease while in prison. Certainly the conditions for producing a spontaneous outbreak of diphtheria could scarcely be excelled. Is it not a question worthy of consideration whether we have any right to expose a man to conditions liable to produce grave or fatal disease, even though he be a criminal? Is the production of disease any proper part of the sentence imposed upon a criminal by the judge or jury?

The cess-pool is not ventilated. Some months ago it became filled up and ran over through an opening made into it through the side of the hill near the edge of which it is located. An additional cess-pool has been made a little farther down the hill into which the first cess-pool is made to discharge the fluid portion of its contents by an overflow. The second cess-pool has a trapped opening half-filled with stones, by which, when filled, it may discharge upon the side of the hill and into a street gutter which runs along by the foot of the hill. A rank growth of grass extending alongside of the street plainly marked the course of this foul stream for twenty or thirty rods from the cess-pools, which seem to have been subject to periodical volcanic outbreaks, which were bitterly complained of by the persons residing in the vicinity as being attended by sights and smells of most disgusting character.

The soil pipe, instead of being carried up above the roof, is extended up the large ventilating shaft to a point just opposite the register opening communicating with the court room, so that all foul gases accumulating in the cess-pool from the foul deposits of years are discharged through this pipe. When it is recalled that the direction of the air current through this register is wholly at the mercy of the wind and the windows, it is apparent that this arrangement is the best calculated to secure a wholesale poisoning with sewer gas that could possibly be devised. This court room is well fitted for a hall of execution, and a full inquiry into its history might reveal the fact that lawyers, witnesses, jurors and judges, as well as prisoners at the bar, have suffered the full penalty of the law for sanitary crime for which some ignorant architect is alone responsible. I might mention a considerable number of sanitary defects in addition to the foregoing, but will not add to the length of this report by so doing. I would offer the following suggestions for improvements:

1. Independent ventilation shafts should be constructed for each story. The present shafts and ducts may be advantageously used, but should be materially modified and supplemented by others.

2. The prisoners' quarters and the court room at least should be provided with an abundant supply of heated fresh air. The fresh air openings should have a clear space of not less than one square foot for every ten occupants.

3. I would suggest that the jail apartments might be easily and efficiently ventilated by means of ducts running from the far ends of the corridors, and placed next the ceiling and outside the partition separating the jail from the hall of the basement, and connected with the individual cells in a manner explained to the sheriff.

4. The old system of sewerage should be wholly abandoned and thoroughly removed, together with the accumulation of sewage under the house. The removal is a matter fully as essential as the abandonment of the present most improper and defective system.

5. The old cesspools should be thoroughly cleaned out and disinfected as far as possible.

6. The new sewer should be laid with good glazed tile or cast iron soil pipe. The latter is inferior to glazed tile.

7. The traps of the closets should be placed above the floor so that they can be easily reached in case of obstruction occurring.

8. A receiving chamber of proper size should be constructed just outside the building, into which the sewer should discharge so that anything which might pass the trap of a closet may be caught and removed instead of passing on to form an obstruction at some point less accessible. This basin should be so constructed as to be easy of access.

9. The sewage should be conveyed away to a stream of sufficient size to carry it off without producing a nuisance, or, in case this is not practicable, which seemed to me to be the case—the sewage may be received into a water-tight cesspool. The cesspool may be constructed in the side of the hill that it may readily be emptied without pumping by a pipe running from the bottom of the cesspool in a downward direction and out at the side of the hill. This pipe could be closed by a gate which could be easily removed when necessary.

10. I think a cesspool of the sort described is the only satisfactory means of disposing of the sewage in this case, and would recommend its adoption. It is important that the cesspool should be thoroughly water tight and made of durable material. It would be well to construct it of brick and lime with cement, and cover the inside with several layers of coal tar. The brick must be hard burned and should be laid in cement.

11. The cesspool should be ventilated by a pipe of ample capacity, say six inches in diameter. The catch basin should also be ventilated. There should be no trap in the main sewer. The soil pipe should be carried on up above the roof.

12. All sinks should have an independent sewer leading to the catch basin, wholly independent of the sewer connected with the water closets.

13. Prisoners suffering with contagious diseases should have quarters provided for them at some place more remote from the common corridors and where they can be completely isolated. J. H. KELLOGG.

I am glad to be able to state that the most important of the suggestions were promptly adopted by the board of supervisors, and will be promptly corrected. J. H. KELLOGG.

NATIONAL CONFERENCE OF STATE BOARDS OF HEALTH.

MEETING AT TORONTO, ONTARIO, OCTOBER, 1886.

REPORT OF ATTENDANCE BY HENRY B. BAKER.

The annual meeting of the association of secretaries and other representatives of the State Boards of Health was held in Toronto, Ontario, on October 4, the day preceding and from time to time Oct. 5-8, during the meeting of the American Public Health Association. Most of the States of the Union and the provinces of the Dominion of Canada were represented, thus making it an international meeting. One eminent sanitarian from abroad was present, namely James B. Russell, M. D., the veteran health officer of Glasgow, Scotland. J. N. McCormack, M. D., of Kentucky, served as president, and G. P. Conn, M. D., of New Hampshire, as secretary. These officers were re-elected for 1887.

A comparison of sanitary laws was commenced.

The transportation of dead bodies, including those dead from dangerous communicable diseases, was discussed at some length, and much difference of opinion developed, showing the need for much further comparison of views in order that some agreement shall be reached; because bodies dead from dangerous diseases are probably going to continue to be transported from one distant State to another throughout this country under imperfect control by health authorities, until such time as those authorities shall come to some agreement among themselves as to what is best to be done to prevent the spread of communicable diseases by such removals, and to prevent nuisances from bodies dead from non-communicable causes.

C. N. Hewitt, M. D., of Minnesota opened a discussion of how local boards of health shall be organized and directed so as to do the most good.

J. H. Rauch, M. D., of Illinois, spoke on the subject of coöperation of those State boards of health which are charged with the duty of regulating medical practice in the interests of public health and safety.

PRACTICAL RESULTS IN PREVENTING AND RESTRICTING COMMUNICABLE DISEASES.

The program called for a discussion of the following proposition from Kentucky:

"What have been the actual practical results secured, outside of large cities and towns, in preventing the spread of scarlet fever, measles, diphtheria and typhoid fever, and how is the coöperation of the medical profession and the general public best secured in such work?"

The discussion was opened by Henry B. Baker, M. D., secretary of the Michigan State Board of Health, who, after preliminary remarks, presented the following:

The Michigan State Board of Health was established in 1873. Late in that year the board issued a circular to physicians stating the duties of physicians and others under the law in dealing with "small-pox and other diseases dangerous to the public health;" also showing the relative danger to the public health from the various communicable diseases. The circular showed that scarlet fever caused more deaths by far than small-pox, and it was urged that if scarlet fever was properly restricted, the deaths from that disease might be greatly lessened. The circulars were distributed to the physicians throughout the State. From that time forward scarlet fever in Michigan has been treated by the State Board of Health as a dangerous communicable disease, and at present isolation and disinfection are quite generally enforced by local boards.

TABLE 1.—*Deaths from Scarlet Fever, reported to the Secretary of State, as having occurred in Michigan during the five years, 1869–73, compared with the eleven years, 1874–84; 1873 being the year, in the latter part of which the Michigan State Board of Health was established and began its work. Also a comparison of the three years 1874–6, with the eight years, 1877–84; the Document on the Restriction and Prevention of Scarlet Fever having been issued by the State Board of Health in 1877, and distributed each year since that date.*

Years. (Five.)	Deaths.	Years. (Eleven.)	Deaths.	Years. (Three.)	Deaths.	Years. (Eight.)	Deaths.
1869	252	1874	440	1874	440	1877	404
1870	852	1875	423	1875	423	1878	429
1871	696	1876	399	1876	399	1879	418
1872	565	1877	404			1880	370
1873	580	1878	429			1881	383
		1879	418			1882	592
		1880	370			1883	673
		1881	383			1884	326
		1882	592				
		1883	673				
		1884	326				
Sums......	2,945	....	4,857	....	1,262	....	3,595
Averages..	589	....	442	....	421	....	449

I submit a table (No. 1) in which the deaths from scarlet fever reported to the Secretary of State as having occurred in Michigan during the five years (1869–73) immediately preceding the organization of the State Board of Health, is compared with the eleven years, 1874–84, the period of restriction since the Michigan Board was established.

In table 1, I have also studied the effect of the circulation of a document giving detailed information relative to the restriction and prevention of scarlet fever. Such a document was issued by the Michigan State Board of Health in 1877, and has been distributed thoroughly each year since. I have compared the three years, 1874–76, just before the document was issued, with the eight years, 1877–84, since it was issued. Although the average number of deaths reported annually in the latter period is slightly greater than during the three years immediately preceding, partly because the eight-year period contains an epidemic year, there was not an increase but a decrease in the proportion of deaths to population. This is shown in the exhibit (No. 1) in which allowance is made for the actual increase of population, and it is found that during the time of the distribution of the document there was a saving of 64 lives per year, or 512 lives during the eight years compared with the three years in which the State Board labored to prevent the spread of scarlet fever, but did not distribute a document containing full directions how to restrict the disease. By exhibit 1 it will be seen that during the entire period since the organization of the State Board of Health the average deaths per year were 2.1 per 10,000 inhabitants less than in the period previous to that time. The average annual population during the 11-year period is estimated from the population as stated in the Michigan manual to have been 1,609,023. This indicates a saving of 338 lives per year, or 3,718 lives saved from death from this one disease during the first 11 years after the State Board of Health was established. (Statistics for 1885 and 1886 are not yet available.)

EXHIBIT 1.—*A comparison of the Deaths from Scarlet Fever, reported to the Secretary of State as having occurred in Michigan during the five years (1869–73) just preceding the organization of the State Board of Health, with the three years (1874–76) immediately succeeding its organization, and those three years (1874–76) with the eight years (1877–84), during which the document on Restriction of Scarlet Fever was distributed; also the five years (1869–73) just before the establishment of the Board with the eight years (1877–84) during the use of the document; and finally a comparison of the five years (1869–73) just preceding the work of the Board, with the eleven years (1874–84) since the State Board of Health was established.*

Periods of Time Compared.	Estimated Average Population.	Average Deaths Reported per Year.	Total Reported Deaths.	Average Reported Deaths per Year per 10,000 Inhabitants.	Decrease of Deaths per Year per 10,000 Inhabitants.	Average Decrease of Reported Deaths per Year.†	Lives Probably Saved, according to the Reports.*†
5 years, 1869–73	1,215,220	589	2,945	4.85			
3 years, 1874–76	1,384,515	421	1,262	3.04	1.81	252	756
3 years, 1874–76	1,384,515	421	1,262	3.04			
8 years, 1877–84	1,689,988	449	3,595	2.66	.38	64	512
5 years, 1869–73	1,215,220	589	2,945	4.85			
8 years, 1877–84	1,689,988	449	3,595	2.66	2.19	370	2,961
5 years, 1869–73	1,215,220	589	2,945	4.85			
11 years, 1874–84	1,609,023	442	4,857	2.75	2.10	338	3,718

* Probably not all deaths were reported before or since the organization of the Board, consequently the saving is probably greater than is here shown.

† Allowing for increase of population.

TABLE 2.—*Deaths from Small-pox reported to the Secretary of State as having occurred in Michigan during the five years 1869–73, compared with the eleven years 1874–84; 1873 being the year, in the latter part of which the Michigan State Board of Health was established and began its work. Also a comparison for the four years 1874–77 with the seven years 1878–84; the Document on the Restriction and Prevention of Small-pox having been issued by the State Board of Health in 1878, and distributed each year since that date.*

Years. (Five.)	Deaths.	Years. (Eleven.)	Deaths.	Years. (Four.)	Deaths.	Years. (Seven.)	Deaths.
1869	42	1874	18	1874	18	1878	6
1870	9	1875	26	1875	26	1879	6
1871	73	1876	76	1876	76	1880	3
1872	302	1877	102	1877	102	1881	82
1873	90	1878	6			1882	100
		1879	6			1883	5
		1880	3			1884	3
		1881	82				
		1882	100				
		1883	5				
		1884	3				
Sums......	516	....	427	....	222	....	205
Averages..	103	....	39	....	56	....	29

In table 1 it is seen that during the 11 years of the work of the State Board of Health the deaths from scarlet fever, as reported to the Secretary of State, were reduced in the aggregate about one-fourth, notwithstanding the increase of population. Although this is an important reduction, table 2 shows that small-pox was reduced about two-thirds. The greater success in restricting small-pox is probably due to the fact that for small-pox we have the additional advantage of vaccination in preventing and modifying the disease.

EXHIBIT 2.—*A comparison of the deaths from Small-pox, reported to the Secretary of State as having occurred in Michigan during the five years (1869–73) preceding the organization of the State Board of Health, with the four years (1874–77) immediately succeeding its organization, and those four years (1874–77) with the seven years (1878–84) during which the Document on the Prevention of Small-pox was distributed; also the five years (1869–73), just before the Board was established, with the seven years (1878–84) during the use of the Document; and finally a comparison of the five years (1869–73) just preceding the work of the Board, with the eleven years (1874–84) since the State Board of Health was established.*

Periods of Time Compared.	Estimated Average Population.	Average Deaths Reported per Year.	Total Deaths Reported.	Average Deaths Reported per Year per 100,000 Inhabitants.	Decrease of Deaths per Year per 100,000 Inhabitants.	Average Decrease o. Reported Deaths per Year.†	Lives Saved during the Period, according to the Reports.*†
{ 5 years, 1869–73...	1,215,220	103	516	8.48			
{ 4 years, 1874–77...	1,409,758	56	222	3.97	4.51	64	256
{ 4 years, 1874–77...	1,409,758	56	222	3.97			
{ 7 years, 1878–84...	1,696,034	29	205	1.71	2.26	38	268
{ 5 years, 1869–73...	1,215,220	103	516	8.48			
{ 7 years, 1878–84...	1,696,034	29	205	1.71	6.77	115	806
{ 5 years, 1869–73...	1,215,220	103	516	8.48			
{ 11 years, 1874–84..	1,609,023	39	427	2.42	6.06	98	1,073

* Probably not all deaths were reported before or since the organization of the Board, consequently the saving is probably greater than is here shown.
Allowing for increase of population.

In order to ascertain the advantage of the distribution of the "Document on the Restriction and Prevention of Small-pox," I have made in Exhibit 2 a comparison between the periods of restriction without the document and the period of restriction with the document; that is a comparison of the period 1874–77 with the period 1878–84. This indicates that during the time of the circulation of that document there was saved an average of thirty-eight lives per annum, or 268 lives during the seven-year period. The total number of deaths from small-pox reported to the Secretary of State during that period was 205, which was 31 less than half the number which would have been reported if the deaths from small-pox had continued at the same rate as during the four years just preceding the distribution of the document.

In exhibit 2 it may be seen that during the entire period since the State Board of Health has been working, the average deaths from small-pox were 6.06 per 100,000 inhabitants less than during the period of five years just before the establishment of the Board. This shows a saving of 98 lives per year, or 1,073 lives saved during the period of 11 years; that is, there were 1,073 less deaths from small-pox during this period than there would have been had the deaths continued at the same rate as before the work of the Board commenced.

Thus, from the two diseases, scarlet fever and small-pox, there is indicated by the statistics in the office of the Secretary of State to have been a saving of nearly 5,000 (4,791) lives in Michigan during the eleven years following the establishment of the State Board of Health.

[Since the Toronto meeting Dr. Baker has added comments as follows:]

[The question may arise whether some part of the decline in the mortality from small-pox and scarlet fever, shown to have occurred in Michigan, may not be due to general sanitary progress rather than to the measures of prompt notification, isolation, disinfection, etc., under the lead and direction of the State Board of Health. On this question as good evidence apparently as is necessary is at hand. Wm. Squire, M. D., F. R. C. P., a prominent member of the Epidemiological Society of London, England, has lately said: "Diseases propagated by personal infection, such as scarlet fever and small-pox, have shown no diminution under our extensive sanitary works, but require measures of isolation for their control; they are not checked by the great improvements in drainage and water-supply that have proved so efficacious against the prevalence of diarrhœal diseases, and especially in diminishing the amount of enteric fever. Both these points are proved in the reports of the Registrar-General." *

Except in certain districts, the law in England does not require as does the law in Michigan that the householder or physician shall promptly notify the health officer on the occurrence of a dangerous communicable disease. Sanitarians in that country have now become convinced that those diseases "require measures of isolation for their control" and at the last meeting of the British Medical Association, after the discussion of a paper on the best means for the prevention of scarlet fever, the public health section of the association passed a resolution as follows:

"That the public health section, having considered the paper read and the remarks made, are of opinion that the time has arrived when the protection afforded by the powers for the compulsory notification of infectious diseases should be extended to the population generally; and they therefore recommend the council of the association to consider at an early date the advisability of endeavoring to promote general legislation with this object in view."*

In England, therefore, sanitarians are endeavoring to establish those methods for the prevention of scarlet fever which have already been found so successful in Michigan.

It should be understood, however, that something more is required than a law compelling prompt notice of dangerous diseases. In Michigan such a law had been passed many years ago, but not the slightest attention had ever been given to it until the State Board of Health put life and system into that as into other public health work throughout the State.

It is reasonable to believe then from the various lines of evidence, that the decrease in deaths from small-pox and scarlet fever in Michigan during the years when prompt notification, isolation, and disinfection in these diseases have been attempted, has been due to those measures. Especially does it seem true when we consider that these communicable diseases both tend to increase with increasing facilities for travel and rapid communication among the people by railroad and otherwise as has been the case in Michigan.

Irrespective of the cause, however, the fact is certainly a gratifying one, that nearly five thousand (4,791) persons in Michigan are yet alive who would have died from small-pox or scarlet fever if the deaths from those two diseases had continued at the same rate as during the five years just preceding the establishment of the State Board of Health.]

*British Medical Journal, Oct. 30, 1886, page 812.

COÖPERATION OF THE MEDICAL PROFESSION.

In my opinion the coöperation of the medical profession can be, and is, best secured by educating the people who employ and pay the physicians, so that the people will prefer the physician who acts for the prevention of disease rather than the one who does not so act. Public sentiment will then make coöperation easy. It is asking too much of the medical profession to ask physicians to go far in advance of public sentiment in efforts for preventing the spread of communicable diseases. Self-preservation is as much a "first law of nature" to the medical profession as to other classes of human beings. It is fair to assume that in the future as in the past physicians will continue to lead in philanthropic work, especially in this branch of sanitary reform; but I consider it the duty of practical sanitarians—certainly the duty of all of us who are connected with State Boards of Health—to see to it that, so far as possible, public sentiment be constantly advanced so as to keep pace with the rapid progress in the medical profession. If we expect the physicians to coöperate with us in efforts to prevent the spread of consumption, or any one of the diseases mentioned in the proposition, we must ourselves lead off, and allow them to coöperate, and not expect them to do all of the work.

COÖPERATION OF THE GENERAL PUBLIC.

One of the best methods of securing the coöperation of the general public is the popular sanitary convention. Here scientific nomenclature is cast aside and the truths of science are clothed with the language of the people. Here statistics become charged with the enthusiasm of the speaker, the inattentive become attentive, and the blind begin to see. Two or three such conventions are held in Michigan every year. At times very large audiences attend. They command a large amount of space in the local papers and in the daily press of the State, and after the convention 2,000 copies of the proceedings are printed and distributed among those people likely to read them. Papers have been read before these conventions by many of the most prominent ministers, lawyers, professors and doctors of the State.

Another way to compel the attention of the people is to take them when they are threatened with disease and death. For some time the Michigan State Board of Health has been in the habit of sending to those localities in the State where a dangerous communicable disease is known to exist, copies of a pamphlet on the restriction and prevention of that particular disease. These pamphlets have been distributed among the neighbors of those sick with the disease, and have been pronounced by health officers "a great help in restricting the spread of the disease." But the educational effect of the distribution of these pamphlets in this manner, their effect in forming public sentiment favorable to the restriction and prevention of diseases, is of even greater prospective importance than is the immediate result.

HYGIENE IN SCHOOLS.

J. Berrien Lindsley, M. D., of Tennessee, opened the discussion of the subject of best methods of teaching hygiene in schools of low grade, and how much should be attempted in this direction.

INVESTIGATION OF THE CAUSES OF DISEASES—HOW CAN STATE BOARDS OF HEALTH SECURE THE BEST RESULTS?

Charles H. Fisher, M. D., of Rhode Island, opened the discussion of this subject.

During the discussion of this subject Dr. Henry B. Baker of Michigan presented the following:

Elsewhere and heretofore sickness statistics, for a long period of time, have only been obtained for a few communicable diseases, with regard to which compulsory notification is enforced; but we now have established, in the State of Michigan, a system which enables us to have reliable statistics of sickness from all the important diseases. The system is based upon the law of averages, which makes it probable that one hundred or more physicians in active general practice in different parts of the State will, on the average, see an average of the several diseases which ordinarily occur, and those are the diseases which cause most sickness and most deaths, and consequently are the diseases which it is most important to study with the view to learning the manner of their causation. The reports concerning sickness, published by the Michigan State Board of Health, show the relative prevalence of sickness from each important disease, in each month, and in each year, and from each disease compared with other diseases. They thus show the relative danger from each disease compared with other diseases, and compared with the same disease in other years, or in other months in the same year. These statistics are based on the actual observation of physicians in different parts of the State. It has been alleged that these statistics give only the *opinions* of physicians*; but this is an error, the weekly reports of sickness now being statements of fact as to whether the physician did or did not observe the disease in question during the week for which the report was made.

"Collective Investigation of Disease" has thus in Michigan been put upon a scientific basis. It must, I think, be admitted that for the purpose of learning the causes of diseases, sickness statistics are far more valuable than statistics of deaths, therefore, as an answer to this question before the conference, I respectfully submit our present methods in Michigan, namely, weekly reports by representative physicians of all sickness under their observation, together with regular observations by representative meterologists, of conditions likely to affect diseases. I submit a copy of postal blank used in Michigan:

*Public health : Transactions of Am. Public Health Association, Vol. XI, page 60.

Diseases in................................[and vicinity?]
PLEASE DATE.
week ending Sat.,......................., *188*...

No......		Prevalence. Order. See a.	Cases.
ED. 25.	Brain, Inflammation of.....	....	....
	Bowels, Inflammation of....	....	....
	Bronchitis................	....	....
	Cerebro-spinal Meningitis.	....	....
	Cholera Infantum	....	....
	Cholera Morbus............	....	....
	Consumption, Pulmonary..	....	....
	Croup, Membranous........	....	....
	Diphtheria	....	....
	Diarrhea..................	....	....
	Dysentery.................	....	....
	Erysipelas................	....	....
	Fever, Intermittent........	....	....
	Fever, Remittent...........	....	....
	Fever, Typhoid (Enteric)..	....	....
	Fever, Typho-malarial......	....	....
	Influenza	....	....
	Kidney, Inflammation of....	....	....
	Measles	....	....
	Neuralgia	....	....
	Pneumonia................	....	....
	Puerperal Fever...........	....	....
	Rheumatism	....	....
	Scarlatina................	....	....
	Small-pox.................	....	....
	Tonsilitis	....	....
	Whooping-cough	....	....
	....	....	....

a. Please mark the disease of which there is the greatest number of cases, 1; the disease having next greatest number of cases, 2; the next, 3; and so on for each disease, writing the same figures opposite diseases having the same number of cases. Write 0 opposite each disease of which there is no case under your observation. [For full statement of plan, see second, third, and fourth pages of record-book cover.] A blank indicates that the item has been overlooked.

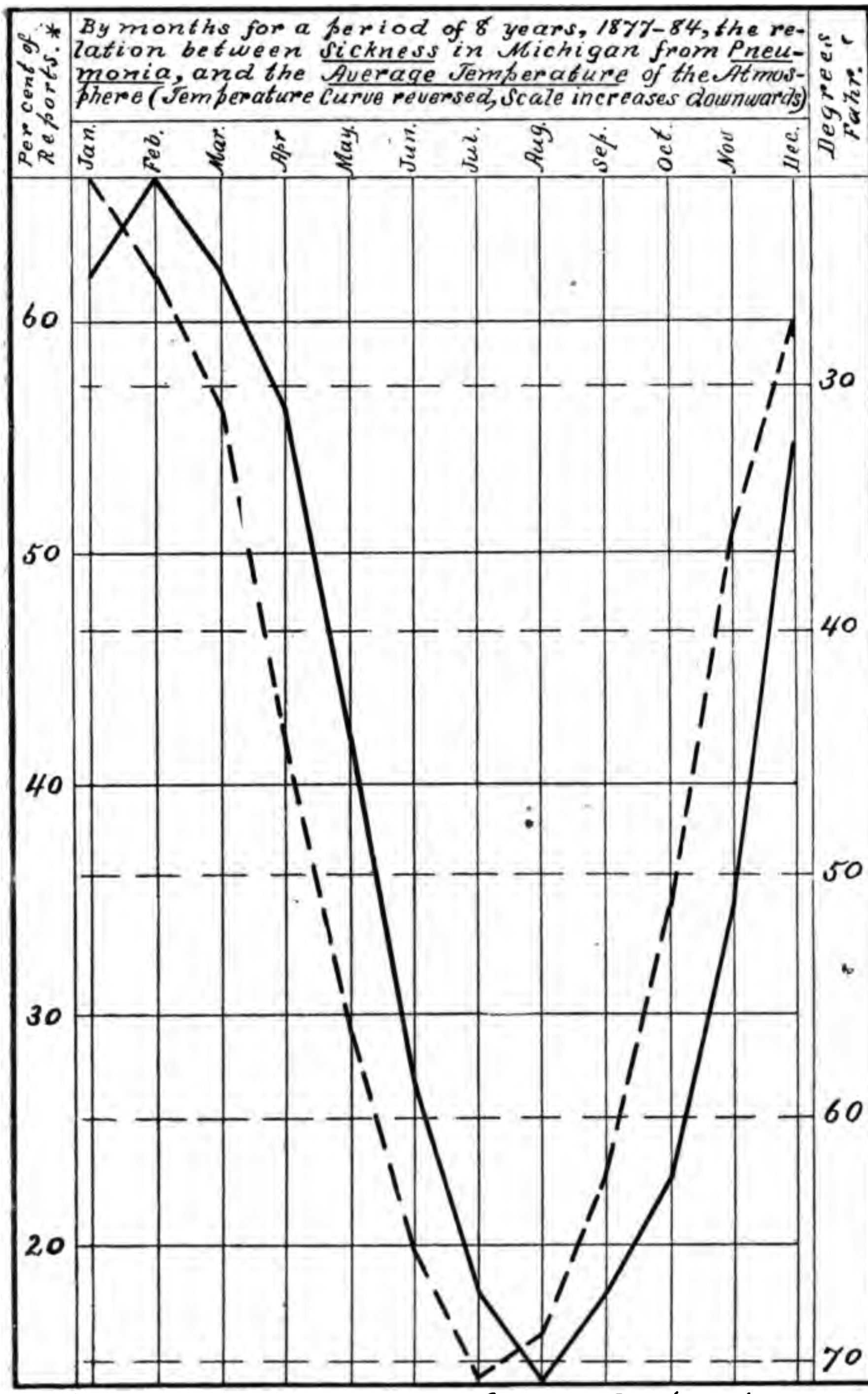
Please mail this, signed and dated, as soon as convenient after close of week specified.

This report is of diseases UNDER YOUR OBSERVATION; if it includes a contagious disease, please mention, on the bottom or margin of this card, the township, city, or village in which the disease is.

....

...., *M. D.*

I also submit a diagram illustrating one method of preparing such statistics of sickness and of meteorological conditions in a way to be effective and useful.



Sickness from Pneumonia ———. Average Temperature — —.
*Indicating what per cent of all reports received, stated the presence of pneumonia then under the observation of the physicians reporting.

Over 30,000 weekly reports of sickness, and over 150,000 observations of the atmospheric temperature are represented in this diagram.

C. N. Metcalf, M. D., of Indiana, read a history of investigation of the plumbing of the new capitol of Indiana, and asked advice of the expert members of the conference on certain points involved. A committee of experts was appointed and the subject referred to that committee, which committee reported at a later day.

THE PREVENTION OF CONSUMPTION.

At the meeting of the conference in Washington a resolution offered by Dr. Henry B. Baker, of Michigan, was, on his motion, referred to this meeting for discussion. The resolution is as follows:

Resolved, That it now seems probable that progress can be made in the restriction of that disease which in this country causes more deaths than any other disease, namely, consumption, by declaring to the people that care should be taken to destroy or disinfect the sputa from persons suffering from pulmonary consumption.

In opening the discussion Dr. Baker said that he had prepared, but would not take the time of the conference to read, memoranda of recent literature on the subject, embracing examples of direct infection by tubercle, and other considerations tending to show the importance of the disinfection of tuberculous matter. He assumed that all present were familiar with the literature of the subject, and so would proceed to practical questions which we must consider. As a reminder of the importance of consumption as a cause of death he exhibited a diagram (page 119, report of the Rhode Island State Board of Health, 1885) of the comparative mortality from 15 most important causes of death in Rhode Island during the 25 years—1860–1884, inclusive—showing that the deaths from consumption in that State were more than twice as many as from the next most important cause of death. The question before us was, he thought, whether we were all agreed that consumption can probably be lessened by efforts in this direction. If we are, the sooner the work begins the better; but if we are not, perhaps more harm than good will result by one or more State Boards of Health teaching the people to make such efforts. If the majority of those who control the State Boards of Health are sceptical, and will not support a movement in this direction, then we must delay action; but if the conference is strong in the belief that something can be done for the prevention of this most important of all diseases, then his view was that the work for its prevention should immediately begin. He would vote for the adoption of the resolution.

If the resolution shall be adopted a practical question then is, *how* shall we disinfect? On this point Dr. Baker read from a letter received from Dr. George M. Sternberg, as follows:

"In reply to your letter of September 2 I would say that I consider the subject referred to one of prime importance, I am decidedly in favor of the adoption of the resolution introduced by you at the last meeting of the conference of State Boards of Health. I consider the oxidizing disinfectants the most useful for the purpose indicated, inasmuch as they destroy the albuminous material in which bacilli are imbedded, and thus permit the disinfecting agent, if present in sufficient quantity, to act directly upon the bacilli and ensure their destruction. Labarraque's solution, or a solution of chloride of lime, used in sufficient quantity to completely dissolve and destroy by oxidation the sputa and the contained bacilli, seem to me to be the most useful agents for this purpose. So far as cheapness and efficient-

action are concerned we can scarcely ask for anything better than a solution of chloride of lime containing eight ounces to the gallon of water."

[After several had spoken the resolution was adopted unanimously.]

INTERSTATE NOTIFICATION OF OCCURRENCE OF DANGEROUS COMMUNICABLE DISEASES.

P. H. Bryce, M. D., of Ontario, appointed a committee on this subject at the Washington meeting, reported, more especially, however, with reference to the introduction of diseases from abroad by way of the St. Lawrence river, and the spread of such diseases back and forth along the great highways of travel in the north and northwest.

Joseph Holt, M. D., of Louisiana, presented, in a graphic manner, the need for interstate notification, and for free interchange, among health authorities, of reliable information as to the existence of dangerous communicable diseases. Recent experiences with the fever at Biloxi, and other facts and considerations were forcibly placed before the conference by Dr. Holt.

Resolutions were adopted by the conference, and afterwards by the American Public Health Association, as follows:

WHEREAS, It is necessary for the protection and preservation of the public health that prompt information should be given of the existence of cholera, yellow fever, and small-pox; be it

1. *Resolved*, That it is the sense of the National Conference of State Boards of Health that it is the duty of each State, provincial and local board of health in any locality in which said diseases may at any time occur, to furnish immediately information of the existence of such disease to boards of health of neighboring States and provinces, and to local boards in such States as have no State board.

2. *Resolved*, That upon rumor or report of the existence of pestilential disease, and positive definite information thereon not being obtainable from the proper health authorities, this Conference recommends that the health officials of one State shall be privileged and justified to go into another State for the purpose of investigating and establishing the truth or falsity of such reports.

3. *Resolved*, That whenever practicable, the investigations made under the preceding section shall be done with the co-operation of the State or local health authorities.

4. *Resolved*, That any case which presents symptoms seriously suspicious of one of the aforenamed diseases, shall be treated as suspicious, and reported as provided for in cases announced as actual.

5. *Resolved*, That any case respecting which reputable and experienced physicians disagree as to whether the disease is or is not pestilential, shall be reported as suspicious.

6. *Resolved*, That any case, respecting which efforts are made to conceal its existence, full history and true nature, shall be deemed suspicious and so acted upon.

7. *Resolved*, That in accordance with the provisions of the foregoing resolutions, the boards of health of the United States and Canada, represented at this conference, do pledge themselves to an interchange of information as herein provided.

BLANK FORMS FOR A UNIFORM SYSTEM OF VITAL STATISTICS.

On motion made at the meeting of the conference in Washington, Dr. H. B. Baker of Michigan was appointed to report on the subject of blank forms for a uniform system of vital statistics—particularly statistics of deaths. At the meeting in Toronto he made a verbal report covering points somewhat as follows:

First he undertook to show that the adoption of a uniform system by the several States and provinces throughout this country, at this time, was not advisable. Of course there should be a system for the collection of vital statistics by each State, and uniform throughout the State; but to advise

that any system now in use shall apply to every State is to advise the permanent adoption of an imperfect system. In this, as in other branches of science, perfection can only be reached through taking advantage of useful variations through a considerable period of time, and although each State system must be uniform throughout the State this does not prevent the adoption of useful special methods in the large cities within the State, nor of a different system in each one of those large cities, if necessary in order to conform to local peculiarities of laws or customs. He argued that the most important point to be aimed at first was that a reliable and earnest man be secured to supervise and make effective some system in each State; and that instead of that man seeking to make his work absolutely uniform with that in other States, he should seek to embody the best parts of the several systems in use in other States, and thus aim at an ideal perfect system. To do this he should have before him the work done by each of the other States to profit by their failures and by their successes. He should study the best authors on vital statistics, and should have the benefit of discussions in such conferences as this.

After several had spoken, Dr. Baker replied somewhat as follows:

To the suggestion that he had slighted the subject and had not given it careful consideration he replied that this subject was one to which he had given much thought during the last sixteen years, and his report against immediately adopting a uniform system throughout this country was not based on an impulse of the moment, but was made after careful consideration and reconsideration during many years. If each one of us will strive for a perfect system some of us may eventually reach such a degree of perfection as that the system may well be made uniform throughout this country; but we are at present very far from having reached that perfection. His report had dealt strictly with the subject of "blank forms," etc., as it had been assigned to him; but the discussion of his report had largely concerned the methods of collection of vital statistics and what facts should be collected. If he had felt at liberty to have considered these last-mentioned subjects, many items that he had not referred to would have been touched upon in his report.

The committee was continued, and was directed to consider the whole subject of vital statistics.

SHALL THE NATIONAL CONFERENCE OF STATE BOARDS OF HEALTH MERGE IN THE AMERICAN PUBLIC HEALTH ASSOCIATION?

This subject was discussed, but it was voted that the conference continue as a separate organization, because its work is largely concerned with comparisons of views and methods of the different State Boards of Health, with the view to the more general adoption of methods found useful in one State and likely to be applicable in other States. The next meeting is expected to be in Washington, D. C., during the coming International Medical Congress in August, 1887.

ANALYSIS OF 500 DEATHS

OCCURRING IN THE MICHIGAN MUTUAL LIFE INSURANCE COMPANY DURING THE FIRST 18 YEARS OF ITS EXISTENCE, 1867 TO 1886.

BY HENRY F. LYSTER, A. M., M. D., MEMBER OF THE STATE BOARD OF HEALTH AND MEDICAL DIRECTOR OF THE COMPANY.

It will be observed by anyone studying the tables on the pages following this that the causes of death have been divided into six grand divisions. While the classification it not perfect, it is sufficiently so for the purposes intended. The first thing noticeable is the fact that so large a proportion have died from diseases of the respiratory system, viz.: 177, or 35.4 per cent. of the whole number. Of these, 114 (22.8 per cent.), or more than one-fifth of the whole, have died from acute and chronic consumption. In this classification a large number certified to upon the death certificates as having died from other diseases, have been, upon careful investigation and analysis, and in accordance with certain known laws of mortality governing different diseases, grouped together under either the acute or chronic form of phthisis pulmonalis. Among these may be mentioned bronchitis, four cases; laryngitis, one case; ulceration of the larynx, one case; exposure, four cases; general debility, one case; chronic disease, one case; physical prostration, one case; hemorrhage, one case. The addition of these fourteen cases of somewhat doubtful classification to the list of consumptives will naturally give an increased percentage to this disease above what it would have been had the usual methods followed in the construction of tables of mortality been observed.

TABLE 1. — *Analysis of 500 Deaths occurring at ages between 18 and 65 in the Michigan Mutual Life Insurance Company during the first 18 years of its existence.*

	Names and Classification of Diseases.	Number of Deaths.	Average Age.	Average Durat'n of Policy in Years.	Av. Height in feet andinches.	Average Weight in Pounds.	Average Expan'n of Chest in inches.
Nervous System.	Apoplexia (apoplexy)	39	51.10	5.5	5-8.5	163.7	3.25
	Congestio cerebri (congestion of brain)	6	40.66	2.	5-8.70	150.5	3.87
	Degeneratio cerebri (brain degenerat'n)	9	50.10	6.66	5-7.25	155	3.33
	Dipsomania (alcoholism)	2	49.50	8.50	5-8	155	3.00
	Fulminis ictus (stroke of ligntning)	1	51.	2.	5-10	170	3.00
	Inflammatio cerebri (inflammation of brain)	10	50.	8.4	5-7.9	163	3.30
	Insolatio (sunstroke)	1	52.	0.	6-1	170	4.00
	Tetanus (lockjaw)	2	43.50	4.	5-10	140	3.25
	Total deaths, and averages	70	48.48	4.63	5-10.41	158.4	3.38

TABLE 1—*Continued.*

	Names and Classification of Diseases.	Number of Deaths.	Average Age.	Average Durat'n of Policy in Years.	Av. Height in feet andinches.	Average Weight in Pounds.	Average Expan'n of Chest in inches.
Respirat'y System.	Peripneumonia (pneumonia)	62	43.45	3.64	5-9.02	142.24	3.55
	Phthisis pulmonalis (lung consumpt'n)	98	40.17	4.23	5-11.06	139.45	2.93
	Pleuritis (pleurisy)	1	38.	5.	5-10	160	4.25
	Tubercula miliaria acuta (quick consumption)	16	38.35	4.76	5-11.83	147.92	2.93
	Total deaths, and averages	177	39.99	4.41	5-10.48	147.40	3.42
Circulatory System.	Aneurisma (aneurism)	3	41.33	4.66	5-7.83	126.66	3.00
	Angina pectoris (suffocative breast pang)	1	60.	8.	6.	180	4.00
	Morbi cordis (heart disease)	23	53.60	6.	5-7.64	174.45	3.12
	Pericarditis rheumatismus (rheumatism of heart sack)	6	37.80	2.6	5-7.8	151.6	3.80
	Total deaths, and averages	33	48.18	5.32	5-8.82	158.18	3.48
Digestive System.	Diarrhœa chronici (chronic diarrhœa)	2	31.50	3.50	5-6	129	3.25
	Dysenteria (dysentery)	3	46.33	2.	5-9.66	163.33	3.33
	Gastroenteritis (inflammation of stomach and intestines)	3	54.	3.66	5-10.16	168.33	2.83
	Hepatitis (inflammation of liver)	5	35.50	3.	5-6.60	136.40	2.90
	Inflammatio ventriculi (inflammation of stomach)	8	43.	2.75	5-8.87	162.12	3.34
	Morbi intestinorum (diseases of intestines)	2					
	Morbi jecinoris (liver diseases)	7	46.57	2.57	5-9.64	150	3.14
	Morbi ventriculi (stomach diseases)	2	35.5	4.	5-9.75	137.50	2.75
	Peritonitis	12	40.5	4.08	5-9.33	175.66	3.14
	Total deaths, and averages	44	41.61	3.20	5-8.75	152.79	3.09
Urinary System.	Cystitis (inflammation of bladder)	6	54.	6.16	5-9.50	192	2.95
	Morbi Brightii longus (Bright's diseases)	16	54.5	7.85	5-8.14	166.35	3.32
	Total deaths, and averages	22	54.25	7.01	5-8.82	179.18	3.14
General Diseases.	Accidenti (Accidents)	34	40.07	3.80	5-7	148.42	2.75
	Carcinoma (cancer)	22	48.90	4.76	5-7.3	160.38	3.02
	Erysipelas	3	56.33	8.	5-7	157.50	4.00
	Febris cerebro spinalis (cerebro spinal fever)	8	37.12	2.75	5-7.81	151.25	3.21
	Febris typhoides (typhoid fever)	47	38.54	2.93	5-7.79	156.65	3.16
	Febris puerperarum (child-bed fever)	2	24.	1.	5-3.25	132.25	2.00
	Gangrena senilis (gangrene of old age)	1	62.	11.	6-1	185	3.50
	Gelatus (freezing)	1	50.	2.	5-9.50	155	4.00
	Diabetes mellitus (diabetes)	1	41.	11.	5-8	145	2.00
	Diphtheria	2	41.	2.	5-10	170	4.00
	Rheumatismus acutus (acute rheumatism)	2	57.	4.	5-7.25	142.50	2.75
	Periostitis femoris	1	43.	1.	5-9	140	4.00
	Rigor (congestive chill)	5	53.	2.60	5-10.7	154	3.20
	Inflammatio suppurans (abscess)	3	45.	1.33	5-9.50	148	3.50
	Asthenia (debility)	7	46.85	4.14	5-9.33	175.66	3.14
	Senectus (old age)	1	79.	10.	5-7	192.50	3.00
	Suicidum (suicide)	11	39.27	2.36	5-8.36	154.45	3.50
	Variola (small-pox)	3	34.36	2.66	5-7.33	150	3.00
	Total deaths, and averages	154	46.50	4.30	5-8.28	156.59	3.21
	Total deaths, all causes, and averages	500	45.89	4.38	5-9.03	156.56	3.26

Table No. 2.—*Of 500 Deaths occurring at ages between 18 and 65, in the Michigan Mutual Life Insurance Co. during the first 18 years of its existence, the Deaths from Five Principal Causes, arranged by age.*

Disease.	Period. Years.	Total Deaths.	Average Age.	Av. Durati'n of Policy. Years.	Av. Height in Feet and Inches.	Av. Weight in Lbs.	Av. Chest Measurement in Inches.	
							Expiration.	Inspiration.
Pneumonia.	20-30	5	26.20	2.60	5-9.30	146.00	33.70	36.90
	30-40	23	34.91	2.60	5-7.76	146.87	33.70	35.43
	40-50	15	45.73	3.53	5-8.16	157.26	34.43	38.05
	50-60	15	54.06	5.93	5-7.88	153.53	34.58	37.94
	60-70	4	63.50	4.25	5-6.87	137.00	31.50	34.62
Apoplexy.	30-40	2	33.50	1.50	5-9.50	147.50	32 00	35.75
	40-50	13	44.76	4.23	5-8.69	166.46	36.34	39.76
	50-60	18	55.11	5.61	5-7.94	164.55	35.80	39.23
	60-70	4	63.75	4.75	5-8.12	168.75	36.37	39.12
	70-80	2	72.00	15.00	5-8.00	157.00	35.12	37.75
Typhoid Fever.	20-30	8	26.00	1.56	5-7.40	146.37	33.93	38.81
	30-40	16	34.06	4.56	5-8.14	157.81	34.90	38.13
	40-50	7	44.14	3.28	5-8.28	158.57	35.21	38.75
	50-60	14	52.80	3.07	5-7.92	149.13	35.93	39.01
	60-70	2	61.50	8.00	5-11.00	155.00	32.12	34.87
Lung Consumption	20-30	19	26.84	2.63	5-10.68	144.26	32.56	35.51
	30-40	36	34.31	3.74	5-10.31	147.02	33.55	36.48
	40-50	26	44.40	6.04	6-0.88	147.16	34.10	37.78
	50-60	15	54.00	5.00	5-9.50	138.00	33.10	36.00
	60-70	1	64.00	5.00	5-9.00	135.00	33.00	36.00
	70-80	1	76.00	8.00				
Acute Miliary Tuberculosis.	20-30	1	29.00	1.00	6-0.00	145.00	33.00	37.00
	30-40	9	33.44	4.88	5-11.22	137.50	32.33	35.00
	40-50	4	45.00	3.87	5-7.00	139.50	34.62	37.12
	50-60	2	52.00	5.50	5-11.10	190.00	38.75	41.87

The per cent of deaths of members of the Michigan Mutual Life Insurance Company, for 18 years, from 1867 to 1886, was as follows:

From Phthisis Pulmonalis (all forms)	22.80
Pneumonia	12.40
Enteric Fever	9.40
Apoplexy and Paralysis	7.80

The average age of decedents from both forms of consumption was 39.26 years; while the average age of the five hundred decedents from all forms of diseases specified (including phthisis pulmonalis) was 45.89 years. This goes to prove that phthisical persons do not approach the average age of the other insured persons dying from other forms of disease.

The residence in the company of phthisical persons averaged 4.49 years, as against 4.30 years, the average for all the decedents. While a large number of consumptives expired within a year or two after admission, there were sufficient old members who had been insured many years dying from this disease, to bring up the general average to plus the general average for all persons dying. While this is the fact, the total of deaths from phthisis has been materially increased from a want of professional acumen and skill on the part of medical examiners at the entrance of the applicants into the company, and in their not infrequently overlooking or misinterpreting the earlier symptoms and signs of phthisis pulmonalis and mistaking them for those of dyspepsia, chronic malaria, and for temporary affections of the air passages.

In considering the question as to how far heredity may have influenced the development of pulmonary phthisis, an investigation into the family history of the 114 persons who died from acute and chronic consumption showed that 53 near relatives had died from consumption at the date of the entrance of these members into the company. In 19 cases the father, and in 11 cases the mother, had died from this disease at that date. Among the whole number 14 brothers and 9 sisters had died from consumption before the date of entrance of the insured into this company. It should be inferred that a very considerable addition might be made to these figures in the average period of 4½ years that the life of the policies of persons of this class lasted. The above figures show that heredity enters very largely into the probability that the natural expectancy of life will not be reached by this class of applicants, and that the rates for insurance will fail to be remunerative when a hereditary strumous diathesis is shown in the application.

The large number of decedents from pneumonia—62, or 12.4 per cent of 500—is very suggestive of the fact that pneumonia is the gateway through which pass out those dying from a variety of diseases. Upon studying these deaths it will be observed that an unusually large number—28—died within 2.6 years of their admission to the company. These had not reached the age of forty years. How large a proportion of these decedents were in all probability cases of consumption will be shown when we observe the fact that of the 62 certified as having died from pneumonia, the fathers of three, the mothers of seven, and two sisters of two, had died from consumption at the date of the entrance of the members to the company, and were from the families of the younger of these decedents. Pneumonia is a very frequent proximate cause of death in acute fevers of a severe type, in acute bronchitis, in Bright's diseases, in phthisis pulmonalis, in pyæmia and septicæmia, in general debility, in apoplexy and cerebral degenerations, in chronic alcoholism, and in old age.

The recoveries from pneumonia, other things being equal, will be in proportion to the youth of the patient. Among the causes of death of the near relatives of the 62 decedents from pneumonia, six fathers, four mothers, six brothers and seven sisters died from pneumonia before the entrance of the

applicants into this company. While this number may not be a very unusual proportion of deaths, as pneumonia ranks in fatality third in general lists of diseases, yet it is suggestive of a strumous diathesis in the family, and is a cloud upon the application of those applying for insurance which should lead the medical examiner to be very particular with reference to any symptoms of incipient phthisis pulmonalis.

I have consulted the hereditary antecedents in one other disease, viz.: apoplexy. Among the 39 decedents there had been at the date of the issue of the policy a report of 11 deaths among near relatives—three fathers, five mothers, two brothers, one sister. The proportion of insured who are in what might be termed the apoplectic decade—60 to 70—is of course quite small as regards the whole membership. This will be seen by consulting the table.

There is undoubtedly a strong hereditary tendency to deaths from apoplexy in some families, and lives which are carried with comparative safety up to 52 or 53, can not be brought into the sixties even with the greatest care. The natural history of the apoplexies is so well understood that it does not require such careful study of applicants for endowment policies who are below 30 or 35 as it does for those applying for insurance who have reached 50 years and over. Here it is of very great importance in the consideration of longevity and probable expectancy of life. In these cases the heredity, occupation, habits, weight, height and temperament should be well considered.

While it would not be in accordance with any correct system or law of comparison to compare the death rates in the company during the eighteen years of its history with the death rates of any two years among the people of the States in which it has transacted its business, still I have thought that it might not be uninteresting to note certain facts as shown in the 9th U. S. census taken June 1, 1870, and the 10th U. S. census taken June 1, 1880. I have herewith appended the following tables derived from these sources:

TABLE 3—*Exhibiting the Population of Indiana, Michigan and Ohio June 1, 1880, and the Mortality from all Diseases per 1,000 persons living (according to the 10th U. S. Census).*

State.	Population. Total.	Death Rate.	Population. (Colored.)	Death Rate.	Population. White Males.	Death Rate.
Indiana	1,978,301	15.78	39,493	25.32	989,953	15.61
Michigan	1,636,937	12.06	22,377	18.57	850,795	11.91
Ohio	3,198,062	13.32	80,142	20.65	1,572,789	13.51

TABLE 4—*Exhibiting the Deaths of Male Persons aged 20 to 70 years, reported to have occurred from certain Diseases in Indiana, Michigan and Ohio during the U. S. Census Year ending June 1, 1880, exclusive of the cities of Indianapolis, Detroit, Cleveland, Cincinnati, Columbus, Dayton and Toledo. The per cent. of Deaths were of persons in five groups of ages.*

Ages in Groups.	Phthisis Pulmonalis. Per Cent.	Pneumonia. Per Cent.	Typhoid Fever. Per Cent.	Apoplexy and Paralysis. Per Cent.
20 to 30 years	32.37	19.11	44.9	4.12
30 to 40 years	21.06	15.70	18.07	8.39
40 to 50 years	17.50	20.07	12.59	13.89
50 to 60 years	15.25	21.14	12.81	23.79
60 to 70 years	13.25	23.90	11.61	49.79
20 to 70	100.00	100.00	100.00	100.00

The per cent of deaths of male persons between the ages of 20 and 70 years in Indiana, Michigan and Ohio for the year ending June 1, 1880, exclusive of the cities of Indianapolis, Detroit, Cleveland, Cincinnati, Columbus, Dayton and Toledo, was as follows, from 10th United States census:

From Phthisis Pulmonalis	23.96	per cent
Pneumonia	11.29	"
Enteric fever	6.31	"
Apoplexy and paralysis	5.02	"

The total deaths of male persons between the ages of 20 and 70 years, not including the cities of Indianapolis, Detroit, Cleveland, Cincinnati, Columbus, Dayton and Toledo, were from phthisis pulmonalis, 3,465; from pneumonia, 1,878; from typhoid fever, 913; from apoplexy and paralysis, 727.

The per cent of deaths of male persons between the ages of 20 and 70 years in Indiana, Michigan and Ohio for the year ending June 1, 1870, according to the 9th census of United States:

From Phthisis pulmonalis (all forms)	31.92	per cent
Pneumonia	8.53	"
Enteric fever	7.32	"
Apoplexy and paralysis	3.78	"

The total deaths of male persons between the ages of 20 and 70 years were:

From Phthisis pulmonalis	3,664
Pneumonia	979
Enteric fever	841
Apoplexy and paralysis	434

In the introduction to the 10th United States census the superintendent remarks as follows:

"The result of each of the four censuses in which an attempt has been made to ascertain the number of persons who died in the United States during the preceding year, have shown that the enumerators did not obtain and record more than 60 to 70 per cent of the actual number of deaths* * *

"The United States has no system of registration of vital statistics such as is relied upon by all other civilized nations, * * * and the deaths which the census gives, imperfect as they are, are the only ones by which we can compare the healthfulness of this with that of other countries, or can ascertain even approximately the relative salubrity or liability to particular forms of disease of different parts of our own territory."

The 10th United States census shows a mortality in male persons between 20 and 70 years of age, in Indiana, Michigan and Ohio, exclusive of the cities of Indianapolis, Detroit, Cleveland, Cincinnati, Columbus, Dayton and Toledo, from consumption of 3,465, in a total mortality from all diseases of 14,460, while the 9th United States census shows a mortality of 3,664 in a total mortality of 11,458.

This discrepancy is too marked to allow us to place much value upon the mortality statistics.

The mean of the two census reports would give the following:

From Phthisis pulmonalis	27.94	per cent
Pneumonia	10.75	"
Enteric fever	6.81	"
Apoplexy and paralysis	4.40	"

INJURIES FROM ILLUMINATING OILS IN MICHIGAN IN 1886.

REPORT BY THE SECRETARY OF THE STATE BOARD OF HEALTH.

Almost coincident with the act for the organization of the Michigan State Board of Health was passed the law requiring the inspection of illuminating oils in Michigan, which was made necessary by the large number of most distressing accidents that were constantly occurring from the use of illuminating oil of low grades. This board was charged with the "general supervision of the interests of the health and life of the citizens of this State," and has uniformly interpreted it as conveying power to inquire into the operation of the law in regard to the inspection of illuminating oil. This interpretation is given support by the fact that the Legislature subsequently directed the State Inspector of Illuminating Oils to make a report to the State Board of Health.

With the heartiest coöperation of the State Inspector of Illuminating Oils, Hon. S. W. La Du, the office of this board has investigated, as thoroughly as practicable, every reported case of a lamp or oil explosion in Michigan during the year 1886. There were five such occurrences reported, from which some property and two lives were destroyed. Besides these, there were three cases reported of injury from the use of gasoline. In August a gasoline stove is said to have exploded in Battle Creek, burning one woman so severely that she subsequently died from the injuries received. A similar case was reported from Adrian, and upon inquiry of the health officer of that city, Dr. Joseph Tripp, he replied as follows:

"Mrs. C. was slightly burned from spilling gasoline on her clothing. Nothing serious. There was no explosion. There was an accident to Mrs. W. T., who lived just out of the city, last March [1886]. It was caused by her spilling the gasoline in her lap and holding the can. She attempted to light her stove, and the fluid took fire, and she was terribly burned, so that her life was despaired of for a long time. There was no explosion in this case."

ALLEGED LAMP EXPLOSION AT GAINES, GENESEE COUNTY.

The Detroit Evening News of April 26 had an account of a fire in Gaines, Mich., caused by the "explosion of a lamp." Plum's drug store and a furniture store were destroyed. Geo. M. Turner, of Flint, a deputy inspector, went to Gaines to investigate the occurrence. On April 30 he wrote to the

Inspector that he tested the oil and it "stood 126°." He came to the conclusion that the lamp was left turned too high, that the burner melted, and the oil was set on fire.

KINDLING A FIRE WITH KEROSENE, AT OSCODA.

The following, to S. W. La Du, from the deputy inspector at East Tawas, and dated March 11, 1886, explains this case:

"I investigated that oil affair at Oscoda this morning. I found the husband of the lady who was burned. The stove was a sheet-iron heating stove, round, damper in front. She took oil in small cup, got down with her face close to the apparatus, threw the oil in, and kept her face right there to get the full benefit of the flame when the oil ignited. They have the same oil on hand now in barrel, bought of E. F. Loud the last of December. I brought some of the oil home and have given it a thorough test, and it does not flash at 123°. The barrel bears my brand of inspection, and is all right."

This account of the way in which the accident occurred agrees with that received from another source. The hands and face of the woman were severely burned.

ALLEGED LAMP EXPLOSIONS AT BAY CITY.

The State Inspector of Illuminating Oils went to Bay City to investigate personally this case; but he could not clearly establish the facts. In the same place there was an explosion on three nights in succession, or at least what was thought to be explosions. Mr. La Du sent one of the lamps to this office. He visited the scene of the explosions, and traced the oil to the retailer and wholesaler, but there was none of the brand in stock anywhere.

The lamp was carefully examined in this office, and the following letter gives the conclusion reached:

OFFICE OF STATE BOARD OF HEALTH,
Lansing, Mich., March 22, 1886.

HON. S. W. LA DU,

State Inspector of Illuminating Oils, Coral, Montcalm Co., Mich..

DEAR SIR:—Please accept thanks for your letter of March 19. I have examined the lamp, which is complete, and find no evidence of there having been an explosion, but do find what would apparently account for the trouble. The neck of the lamp has on four sides a groove, so that when the burner was screwed into it there would still be four little openings, which were probably intended for vents; but whenever the lamp was filled full, and if not full, when the lamp was allowed to tip to one side, the oil would ooze out of one of those openings. The smoke all around these (underneath the burner) shows that the oil was on fire at those places, and was hot enough to melt the solder. The lamp was constructed on a bad plan, and in this instance the burner is not large enough to fill the neck of the lamp. Even Michigan legal test oil might take fire and burn, as it evidently did around the top of this lamp. Of course it would then be in a dangerous condition. The separated burner shows evidences of smoke, but not on the bottom like the other, and I do not see anything conclusive about that. If that burner was on a lamp similar to the one sent to me, the same explanation may apply to that. Very respectfully,

HENRY B. BAKER,
Secretary.

LAMP EXPLOSION AT LUDINGTON.

On Oct. 19 the house, with its contents, belonging to John Knott in Ludington, was burned, loss $1,740; insurance, $1,000. It seems to be clearly established that it was due to the explosion of a lamp. The health officer of Ludington, Dr. F. W. Graham, states positively that it was an explosion of a lamp that caused the fire. Dr. Graham sent a sample of the oil to this office, and it was found to flash at 124°.

The following, from J. H. McCollum, Deputy Inspector at Ludington, to S. W. La Du, gives more information in regard to the occurrence:

"Mrs. Knott tells me that she filled and trimmed her lamps (2) in the morning of that day,—that she used the larger lamp during the evening, and when she retired she lighted the smaller lamp and placed it on the dining-room table, and turned down the wick so that it would not give much light. Her husband was out of town and her son was at a temperance lecture. She had not gone to sleep when she heard the lamp explode. She got up and tried to extinguish the fire with a piece of carpet that was laid down over the regular carpet (which was new) to protect it where the most wear would come, but the smoke was so suffocating that she ran out and aroused the neighbors, who, with water, put out the fire as they supposed, but probably not, as it broke out again later in the night. She says that the evening before she lighted the large lamp and turned down the wick so as to keep a dim light, and it made such a sputtering noise that it made her nervous, and she put it out. The evening of the fire she burned the same (larger) lamp all the evening for light without its making that sputtering noise.

"When she filled her lamps she left a space above the oil of 'about an inch.'

"She purchased the oil about a week before of George Tripp. George Tripp's oil was a part of the carload inspected for Edward Cottin on the 5th of October, and passed satisfactorily. It was from the Cleveland Refining Company, of Cleveland. Since the fire I have been to Tripp's store and inspected a sample of oil taken from the tank from which Mrs. Knott's can was filled, and it passed inspection, flashing at 127°, with the mercury rising at the rate of 5½° per minute.

"Mr. Tripp showed me his bills of purchase of oil since the 1st of January. Two lots of three barrels each were purchased at Grand Rapids (Standard Oil Co.'s oil). One lot in July, inspected by me July 20, which vaporized at 124° (Victor Oil Co., Cleveland, O.,) water white head light, and this present supply, which I inspected both in the barrel and tank.

"I think the defect was in the lamp or trimming."

THE BRONSON HORROR.

In the latter part of March, 1886, a fire occurred in Bronson, Mich., which resulted in the death of Mrs. Hurley and her daughter, and the injury of two others; and the coroner's inquest resulted in a verdict that the fire was caused by the explosion of a metal lamp in the store. The postmaster at Bronson wrote to Mr. La Du that the fire was caused by "explosion of oil brought about by a defective lamp," but he added that the oil was all right. Dr. H. P. Mowry, health officer of Bronson, wrote to this office that he was not sure it was an explosion, but said that there was no doubt that the fire originated from an "electric" lamp.

Dr. Mowry sent a sample of the oil to this office, and upon testing it was found to flash strongly at 121°. Another person tested it and it flashed at 120°, but he does not pretend to be an expert.

COMMUNICABLE DISEASES IN MICHIGAN DURING THE YEAR ENDING DECEMBER 31, 1886.

COMPILED UNDER THE DIRECTION OF THE SECRETARY OF THE STATE BOARD OF HEALTH.

This paper continues a subject treated for the preceding year on pages 227-282 of the Report of the State Board of Health for the year 1885, and for other years in preceding Reports.

Whenever information is received, at this office, of the outbreak in any locality in Michigan of diphtheria, scarlet fever, typhoid fever, small-pox, or glanders, a letter is sent to the health officer of the township, city, or village in which the disease is present (if the name of the health officer has been reported to this office; if not, to the president of the board of health), calling his attention (if the report was not received from him) to the existence of the disease within his territory, indicating his duties and powers and proper measures to be taken in restricting the disease, transmitting documents of instructions with regard to prevention and restriction of the disease, for distribution among families especially exposed to it, and asking for a report of the methods employed for the restriction of the disease, and the results of efforts for suppressing it—and the number of cases and deaths in each outbreak. Except in the case of glanders, for which a special form of letter was employed, the form of the letter generally sent during the year 1886 was substantially the same as that printed on pages 251-252 of the Report of the State Board of Health for the year 1884. With this letter was sent a blank form (L) for notice of the first case of a dangerous communicable disease, a blank form (M) for weekly reports during the continuance of the disease, and the blank form (K) for special final report. These now in use are substantially the same as those printed on pages 253-254 of the Report for 1884.

The large number of replies received in answer to communications in regard to contagious disease, the general desire manifested by health officers for documents on the restriction of communicable diseases, and the general care taken to send complete reports to this office, show an increasing interest among the people, and a commendable effort on the part of the local health authorities to have every means employed to prevent the spread of contagious disease.

DIPHTHERIA IN MICHIGAN—YEAR ENDING DECEMBER 31, 1886.

During the year 1886 there were reported to the office of the State Board of Health 550 outbreaks in 422 localities.* In these outbreaks there were reported 4,244 cases and 982 deaths. In the year 1885† there were reported 467 outbreaks in 396 localities, and 4,018 cases and 964 deaths. There were thus reported in 1886, 26 localities, 83 outbreaks, 226 cases, and 18 deaths more than in 1885. This may be due not to there being more diphtheria in 1886, but to more and better reports; for the methods used by the Board for obtaining reports are being improved every year. Thus during 1886 there were received 239 special final reports at the close of outbreaks of diphtheria, giving information used in the compilation of this article, while in 1885 there were only 82, and in 1884 there were only 68 such reports.

According to the reports for 1886 the average number of cases per outbreak was 7.7, or .9 less than during 1885, and 3.1 less than during 1884; and the average number of deaths was 1.8, or .2 less than in 1885, and .7 less than in 1884. The per cent of deaths to cases reported during the year 1886 was 23, 1 less than shown by the reports for 1885.

On page 201 will be found a map of the State of Michigan exhibiting, for each county, the number of localities where diphtheria is reported to have occurred; also the number of outbreaks, cases, and deaths which were reported to have occurred in each county. From this it may be seen that 25 outbreaks in 17 localities were reported from Montcalm county, which were the largest numbers of each reported from any single county excepting perhaps Wayne, in which the number of outbreaks in the city of Detroit could not be ascertained. The greatest number of cases (1,326) and deaths (356) were reported in Wayne county. Of these, 1,161 cases and 331 deaths were reported from the city of Detroit, in some part of which diphtheria was present each week throughout the year.

SOURCE OF CONTAGIUM.

In 231 outbreaks of diphtheria the reporters (health officer or clerk) were able to trace the disease to its probable source either within or beyond the limits of their respective jurisdictions, and in 180 of these outbreaks the contagium was with various degrees of certainty traced to previous cases of diphtheria, while 51 were attributed to bad sanitary or atmospheric conditions. In 8 outbreaks the disease was regarded by the reporters as of "sporadic" origin. Regarding the source of contagium, in 117 outbreaks the health officers reported in substance that it was unknown to them. The reports evince a concensus of opinion that, whether or not diphtheria may arise without contagium, the disease is certainly contagious.

As has been noticed in previous years (Reports of the Michigan State Board of Health, 1884, p. 258, and 1876, p. 234) large cities were the centers from which the diphtheritic contagium was carried to different parts of the State. For instance, the city of Detroit, in which the disease prevailed without intermission during the entire year, and where 1,161 cases and 331 deaths occurred from this disease, was reported as the direct source of contagium of the outbreaks in twelve different parts of the State; and considering the

* It is sometimes difficult to decide whether cases in a given place constitute one outbreak or more than one. In connection with a table and diagram on following pages the number of outbreaks is stated differently, but a foot-note gives the reasons why.

† See report for 1885, p. 228.

DISTRIBUTION OF DIPHTHERIA REPORTED IN MICHIGAN IN 1886.

great amount of intercourse with that city, it is not improbable that it was the direct cause of still other outbreaks in the State where the source of contagium was not discovered. If all the outbreaks of diphtheria which have originated directly from this single city, together with those outbreaks which have originated from them were known, and also the entire number of cases and deaths resulting from them, it would add emphasis to the importance of the most rigid measures for restricting outbreaks of this disease.

A. E. Wright, M. D., health officer of Ecorse township, Wayne county, reports the source of contagium in the outbreak of diphtheria in his jurisdiction, December 18, 1886, as follows:

"The first case was brought into this township by a girl from here going to Detroit, staying a while, and coming home, brought it with her. She had been in a family where it was."

E. N. Palmer, M. D., health officer of Brooklyn, Jackson county, regarding an outbreak in that village, Oct. 10, 1886, reports as follows:

"Was brought here on the cars from Quincy, Mich. A resident of Cambridge visiting at that place brought a child from there which died the next morning after reaching here."

Dr. O. Millard, health officer of Flint, reports concerning an outbreak in that city, July 1, 1886, as follows: "Supposed to have come from nurse who had the care of diphtheria in Harper Hospital, Detroit, Michigan."

On August 25, 1886, diphtheria broke out in Pontiac, concerning which the health officer, Mason W. Gray, M. D., writes:

"I believe the contagium was brought from Royal Oak by a young man who had but recently recovered. He was employed at this place, and brought clothing from the house where he had been sick with diphtheria."

Of an outbreak in Almer township, Tuscola county, on September 7, J. P. Westfall, health officer, says: "It was brought into my jurisdiction by Mr. Miller's family from Whittemore, Iosco county."

W. B. Hathaway, M. D., health officer of Bloomingdale township, Van Buren county, reports concerning an outbreak on May 6, in his jurisdiction, as follows:

"A young lady visited a neighbor whose family had suffered from the disease in Nov. last; three cases and one death in that family were reported by me in my last report. This visitor caught the disease by handling the clothing of a deceased member of that family."

Concerning an outbreak on October 18 in Alma, the health officer, I. F. Suydam, M. D., reports:

"Of the three patients taken with this disease, two adults nursed at the house of one who died of what was diagnosed as membranous croup, and a boy who was pall-bearer at the funeral of said case."

This raises the question of the relation of croup and diphtheria. Phillips, in the British Medical Journal of June 5, 1886, urges the etiological identity of membranous croup and diphtheria, citing an instance where the instruments which he used in performing tracheotomy on a person suffering with membranous croup were, without being thoroughly disinfected, used in performing a surgical operation on a child 18 months old. Four days later the child was taken with diphtheria, a false membrane forming on the surgical wound. Cormack (Quain's Medical Dictionary, p. 376,) says: "An increasing number of physicians believe that membranous sore throat is always diphtheritic."

P. S. Watson, M. D., health officer of Algonac, reports concerning an outbreak in that village as follows:

"The family had been visiting friends at Woodville. While there, a little child of the family where they were visiting was taken sick and died in a few hours from some disease which was not

recognized as diphtheria. After returning home, and five days after the date of the funeral, one of their own children was taken sick. On sending for a physician it was recognized as diphtheria, and proved fatal in five days. Another child came down about the third day of its brother's illness, and two others followed from one to two days after. I found two dead and two sick, one of whom, died that day."

Of an outbreak in Dorr township, Allegan county, the health officer, Theodore Cole, M. D., states:

"About two months ago the house was occupied by the family of J—— M——, whose child had an attack of the same disease. It is my opinion that the source of contagium in the present case is from the germs still lurking in the house from the former."

In his final report of an outbreak in his jurisdiction, A. J. Cook, health officer of the township of Leighton, Allegan county, states regarding source of contagium:

"During the first three weeks of March last there was a disease prevailing at Moline (just over the line in Dorr township) that the doctors named tonsilitis, of which a number of children died. On March 21 a case of diphtheria was reported to me by the health officer of Dorr township, from whence diphtheria came into the township of Leighton."

H. A. Fortuin, M. D., health officer of Overisel township, in his final report of an outbreak in his jurisdiction on July 24, says: "A family from a neighboring city, in which family diphtheria had been, visited the parents of the patient a few days before the patient was taken."

Dr. L. A. Warsabo, health officer of Coldwater, in his final report of an outbreak of diphtheria in that city on Sept. 10, in which there occurred some 26 cases and five deaths, states:

"It was introduced by a German family who were visiting at Quincy and Hillsdale, and who had a child sick with diphtheria, although it was not recognized as that by the attending physician."

Of an outbreak in the township of Bainbridge, Berrien county, Jan. 18, Geo. F. Stewart, health officer, reports: "Ella Summerville, who had been sick with the disease, was pronounced well by the doctor, and attended school. While there she changed gum with Emma Docktor. Emma died."

W. L. Garrett, health officer of the township of Watervliet, Berrien county, reports concerning an outbreak in his jurisdiction on April 28, as follows:

"Think it came from communication with a family in the adjoining township of Bainbridge, where a case of very malignant diphtheria occurred just previous to the outbreak in this jurisdiction."

Regarding the outbreak on June 4, Dr. Garrett writes:

"Case No. 1 was caused by a person coming into the family who had done a washing of infected clothing of a diphtheria patient."

Concerning source of contagium of an outbreak on May 18, in Orangeville township, Barry county, Donald McLeay, M. D., health officer, reports: "Through contact, a mild form thereof, I understand, being in existence since last fall and winter when several deaths occurred."

On July 29 an outbreak occurred in Douglas township, Montcalm county. Regarding source of contagium Corydon Rice, health officer, writes:

"As near as I can learn, the disease was contracted from the clothes of a boy that died with it about a year ago at a neighboring town. His clothes were brought home and worn this summer by one of his brothers, and he died."

John Stephens, health officer of Rich township, Lapeer county, in his report concerning an outbreak in his jurisdiction, states as follows:

"From the town of Burlington, where the disease had been. Child was laid on the bed to sleep where the bed clothes were not washed nor disinfected. They had had diphtheria about one week before this exposure. [Child was] exposed January 21, taken sick January 26, and died January 30."

Regarding the outbreak on Nov. 16 in Rapid River township, Kalkaska county, A. H. Barden, health officer, states:

"The young lady went to Mancelona (the adjoining township), where the sickness was. The authorities did not call it diphtheria at that time, but the young lady came home, and within nine days she came down with diphtheria."

Thomas W. Huggett, health officer of Marshall township, Calhoun county, reports as follows:

"A lady came from Indiana to visit some friends here, and it is supposed that she brought it in her clothing, as she came from a family where they had the disease."

The following are statements of different health officers regarding source of contagium of outbreaks in their jurisdictions during the year 1886: "From burying a boy who died of the disease outside of the city." "Was imported from Arlington." "Came from the adjoining township (Saline)." "A boy who had the disease came here from the town of Plymouth." "Supposed to have been exposed while in the city of Detroit, as he is a merchant and usually goes there twice a week." "The child first taken returned home from the city of Detroit sick with the disease." "From child attending school." "Supposed to have been contracted in Detroit." "Where the disease prevailed last year." "Started in a house formerly infected with the disease." "By a boy who had lately had diphtheria, and also from persons who had been nursing cases of said disease." "By a person who had been taking care of a patient with diphtheria at Howard City." "Supposed to have been contracted by the child staying at a house where they had diphtheria last fall." "The disease was contracted by the family living in Tawas township." "Person came here from a distance." "Infection brought by persons visiting who were living in an infected district in the county of Houghton." "Was taken sick the day following his return from Detroit, where he had been visiting about ten days." "Young man who had been at work at Otsego came home sick with the disease and gave it to the other members of the family." "Miss T——, of Sherman City, died of diphtheria. Her family, living in this township, were exposed during her sickness." "By visiting in the township of York, where the disease had previously been." "A young man came from another town with sore throat; went into this house and spent the evening without any one suspecting harm." "Family moved into the township." "A neighbor's boy had been out of the city to work, and coming home with a sore throat, made him (the present patient) a visit." "Carried by the father from a family in another district." "The first and fatal case was visiting at Quincy, and came home sick." "These children had been visiting with their parents at T. P.'s in Bronson, Branch county. It is reported that P.'s children had diphtheria." "A woman visiting from Reed City, Mich., carried the disease in her clothing." "Was no doubt Armada, where the disease was contracted by the F. children while visiting about ten days ago, and the W. children playing with them after their return." "Brought by a little girl from adjoining township." "It was brought into my jurisdiction by Mr. M.'s family, from Whittemore, Iosco county." "As near as I can find out, they caught the disease from a family by the name of ——, from Lapeer county." "Contagion was brought to this town by a party who caught it in a sister's house, not properly disinfected, in the township of Marathon, Lapeer county." "Infected at Jackson by attending a funeral." "Brought here from Quincy by infected clothing being washed." "Contracted in a log shanty where diphtheria had previously been."

"They think the disease was taken in Albion." "Came from Sioux City, Iowa, where it was prevailing." "By visiting in Clare county." "From a family visiting in the city of Hillsdale [where they] caught it." "Brought from Mason city to this township." "Girl came to the School for the Blind from Detroit on October 23, and was taken sick with diphtheria on October 26." "In the same neighborhood of the Perry who was sick in August." "Came from adjoining township." "[Brought into the township] first by the Methodist preacher; second by town clerk." "Direct contagium in most of the cases." "There had been diphtheria near our township for some time before we had any." "By contagium." "At school in the township of Holland." "Filth and contagium." "Occurred in a house where it existed last year." "City of Coldwater; school room." "Brought from Big Rapids." "Contracted at Reed City." "Carried in clothing." "Imported." "Brought in by a Dane family." "Brought from Canada." "Contracted at school in town of West Bloomfield." "Contracted in Lake Linden, Houghton county." "Imported." "Detroit." "At the district school." "Probably brought from Howell, where it was prevailing." "Direct exposure to contagium." "Exposure." "Was contracted at Bad Axe." "Contagion." "In a room previously occupied by person sick of same disease." "Contagium." "First exposed at the depot." "Exposure." "From the town of Mancelona." "Of friends from Elkhart, Ind." "Brought here by family." "Infected clothing." "Neglect to use disinfectants." "Brought in from outside by French family." "From Sioux City, Iowa." "At school in Old Mission." "Exposed at Coldwater." "Communicated by infection." "The people were visiting in Muskegon in a neighborhood where there were some cases of diphtheria." "The first person taken had been on a week's visit in the town of Warren, and came home sick with sore throat." "Exposed while attending a funeral of child who died in neighboring village with diphtheria." "The disease, I think, came from Detroit. Mrs. S. had been visiting there, and diphtheria was in her immediate vicinity." "By communication from other places." "Was where had had it about two months before." "Communication from another district." "Brought from East Saginaw by a woman from that city who had been living at house where a patient had died of diphtheria." "From the adjoining township." "Lady going away on a visit and catching the disease and bringing it home with her." "Brought from a lumber camp by one of the family." "A man, P. by name, went to nurse diphtheria in an adjoining township, brought the disease home." "Mr. C. and family came from Detroit on a visit, and soon after Mrs. C. became sick of diphtheria, it being the first case in Southfield for some time. Mr. C.'s neighbors in Detroit being sick of same disease, that was probably the source of contagium." "A boy came here from Union City. The third day after he came he was taken with diphtheria, which was present where the boy came from." "By contagium from ——, who caught it at St. Luke's Hospital, Detroit." "From a boy who had lately had diphtheria, and also from persons who had been nursing cases of said diseases." "The first case reported originated from a mild case of diphtheria which was not reported to me." "Supposed to be from Mrs. W., who had been to Flint to take care of a child of hers sick with diphtheria." "The mother was exposed in Detroit." "Buel township." "There were reported two cases across the road in Sparta." "At Pine River." "Supposed to have contracted the disease at Bloomingdale, Mich." "Parents were away on a visit; the child came down

with the disease a short time after they returned." "Supposed to have come from a nurse that had the care of the above disease in Harper Hospital, Detroit."

DIPHTHERIA ATTRIBUTED TO UNSANITARY CONDITIONS.

Of the statements of the 51 reporters who attributed the outbreaks to unsanitary surroundings, etc., the following are representative:

Orlando C. King, health officer of Victor township, Mason county, writes concerning the outbreak which occurred in his jurisdiction on Jan. 29, as follows:

"Think the disease originated on the premises. * * * * The log house sets very low on a very low piece of heavy clay land, very swampy, cellar not walled up, barn close to the house, premises not very clean, not very good water."

Concerning the outbreak in Warren township, Macomb county, Dr. Wm. H. Smith, health officer, states:

"I could not ascertain that any members of the family had been in contact with the disease. The water in the well was very low and, I found on examination, loaded with organic matter. The surroundings were also very filthy. I consider the disease was caused by this condition of things."

Of an outbreak on Oct. 13, in the village of Lakeview, Montcalm county, A. H. Forsyth, M. D., health officer, states as follows:

"All the cases occurred in rather damp places. Cases 13 and 16 occurred in a house which gets drainage from the barn above. Case 15 occurred in a house in which the disease was five years ago; house rotten and damp. Case 14 was in a damp, wet saloon standing in a sink-hole."

Dr. R. C. Hepburn, health officer of Evart, writes concerning the outbreak in his jurisdiction, on Aug. 12, as follows:

"Not contact with other cases so far as could be traced; but rather mouldy cellars and decaying debris around and under the houses—at least it so seemed to me."

Of the outbreak, on Aug. 10, in Baldwin township, Iosco county, Dr. James S. Reeves, health officer, writes:

"A quantity of decayed potatoes and turnips which were very offensive were hauled away and the little girl rode on the cart at the time."

The doctor further states that she was about five miles from where diphtheria prevailed some months before.

Dr. D. L. Parker, health officer of Marine City, reports concerning an outbreak, on July 31, in that village, as follows: "The case seems to be truly sporadic. The patient had not been away from home for some months previous to the attack, and no diphtheria had been in the village for six weeks preceding the outbreak, and then was at a distance."

But between May 18 and Nov. 10, 1886 (less than six months), Dr. Parker reports five outbreaks of diphtheria in Marine City, and in each he reports the source of contagium as unknown or obscure as in this outbreak. In none of these outbreaks is there reported any efforts at disinfection, and it is quite possible that the germs not having been destroyed by disinfectants were the cause of succeeding outbreaks, although the mode of their transmission, as is often the case, may be obscure.

Dr. David Flora, health officer of Newaygo, in his final report of an outbreak on August 16, in that village, states source of contagium as follows: "A marsh about one-half acre in extent, the surface of which was dried up during our two and a half months' drought, and the effluvia from which was the prime cause." On the first of September, and again on the 19th, Dr. Flora sent final reports which concur substantially with the above in desig-

nating this little marsh as the source of contagium. But in regard to an outbreak which occurred on Sept 27 (seven days later), in which there were 21 cases and five deaths, he states: "I am candid in acknowledging that the source of this last and worst outbreak is wholly unknown to me."

Other health officers reported as follows: "The removal of decomposed vegetable matter along riverside in north part of town for the purpose of making a duck pond." "A change in the weather causing the decay of vegetables; also the sudden change caused a great many to have colds, and from that the sore throat. As near as I could learn the disease was from the same cause." "In one case it was undoubtedly produced from filth under the house. In one other case it was brought by a little girl from an adjoining village." "Due apparently to local causes." "From the use of water drained from marsh and swamp land." "The source of contagium in the first case could not be determined. The two cases following the first contracted the disease from the first. A ditch partly filled with stagnant water was near the house where it occurred."

Concerning the source of contagium in an outbreak on Nov. 27 in Weare township, A. L. Carr, health officer, reports, "not known;" but the attending physician, G. O. Switzer, M. D., writes as follows:

"The first case was in a boy of ten years who had been going to school. I have heard that there have been several cases of sore throat in the neighborhood of the school where the boy attended. I think the cases of sore throat were mild and no physician was called. The boy was taken sick a week ago last Saturday. Did not attend school the following week, although he was not very sick. The next Thursday a brother 17 years of age was taken sick; and on Sunday following another brother and two sisters, aged 19, 15 and 8 years, respectively, were taken sick. None of them were very sick. The family did not know what the trouble was and no physician was called. On last Monday the boy of 17 grew worse, and on Tuesday morning I was sent for. Went and found the whole five sick with diphtheria. Another sister, 22 years of age, came home on Tuesday, and this (Friday) morning I found diphtheria patches in her throat. The boy of 17 died on Wednesday morning."

Dr. T. A. Felch, health officer of Ishpeming township, Marquette county, writes:

"Diphtheria seems to have prevailed here in a mild form for some years, assuming an epidemic form two years ago and again now, both times in a very malignant form."

Of an outbreak in Rich township, Lapeer county, the health officer, John Stephens, states as follows:

"I think it was caught from the hired girl [resident of Marlette, Sanilac county] who had sore throat. Mrs. Rowell judged it best to send her home. The same night that she went home she had to call a doctor and was very sick. She slept with the girl, Eva May Rowell, and waited upon the little twins [all of whom were taken with the disease within from five to ten days later]."

DIFFERENCES IN DIAGNOSIS.

Disagreement in diagnosis frequently occurs, in great part due to different views as to what constitutes diphtheria; physicians frequently holding that nothing is diphtheria except when there is actually found diphtheritic necrosis—the so-called false membrane. The accumulated experience with this disease during its extensive history, and the weight of authority seem to indicate that, in the adult, diphtheria is not, as a rule, characterized by the presence of the false membrane for any considerable time, so that unless seen just at the right time no patch is found, and when found it is likely to be small. Yet such cases are capable of communicating to children unmistakable diphtheria. Also, irrespective of age, there are "benignant cases" where there

is catarrhal manifestation but no membrane forms; * and still others where a membrane forms on organs other than those of the throat and thus escapes detection. These forms of this disease appear to be the most prolific cause of the spread of diphtheria in Michigan. Frequently in such cases the disease is not recognized as anything serious, and a physician is not called, or when one is called the disease being of such a mild form awakens doubts as to its true nature. Whenever there is any question, the patient should be isolated, and disinfection should take place with as much care and thoroughness as if it were a marked case of diphtheria, as diphtheria of even the most malignant type often develops from just such cases.

An outbreak occurred in Mancelona in which there were some thirty cases and several deaths. There was a difference of opinion among the physicians as to whether it was diphtheria or not. On November 26, 1886, a letter was received from Dr. A. H. Rockwell (one of the attending physicians), from which the following is taken:

"In about two-thirds of the cases there have been patches of a white material which have a resemblance to diphtheritic exudation; but on close inspection do not present any of the characteristics of membrane, but is a pulpy deposit and has been limited in most cases to the tonsils. In some of the cases there has been some swelling of the submaxillary glands."

The doctor further states that several physicians regard the disease as diphtheria; several others, including himself, did not so regard it. He continues:

"Yet we have advised that every precaution be taken against exposure, etc.; that true diphtheria might not develop, as it is reasonable to suppose that it sometimes does from some such cases. I have recently had a case of diphtheria. November 14 I was called to a case which, upon the first visit, appeared to be of the same character as the other cases. I was called in the night, however, and it was very difficult to determine its true character, the patient being but three years old; but upon the second visit I was satisfied that the case was one of diphtheria. * * * * The child died from exhaustion in the second week of the disease."

Regarding this outbreak at Mancelona, the health officer, Charles Beaver, M. D., writes as follows:

"All places where there has been diphtheria, or other forms of throat trouble, have been thoroughly disinfected, and I have from the beginning prohibited children from visiting places where there have been such cases. I ordered the school closed for one week, and will watch closely the development of the disease."

Dr. H. R. Hitchcock, health officer of Sand Beach township, Huron county, writes concerning 14 cases of diphtheria (3 deaths) in his jurisdiction, as follows:

"A year ago, you remember, I reported 5 cases of diphtheria, which was sharply criticised by the health officer as being untrue. I have been carefully watching the outgrowth of diphtheria. * * * * In my opinion, if I could get all the facts connected with the different cases, no trouble would be found in directly tracing the spread by the persons who visited the first cases, which the physician in charge called putrid sore throat."

There was reported an outbreak of throat disease in Ypsilanti in which there occurred some 25 cases and 9 deaths. The physicians of that city differed as to whether or not the disease was diphtheria. The Ypsilanti Commercial, of February 5, reported Dr. Edward Batwell, health officer of the city, as stating at a meeting of the local board of health, as follows:

"That we have a fearfully malignant form of throat disease, similar in character to what in former years was called 'putrid sore throat,' no one can deny; but that it is identical with epidemic diphtheria is a subject I am not prepared to admit. * * * *

* Ziemsen, p. 595 (a); and Quain, p. 375.

"In conclusion I desire to say that, though differing from some of my professional brethren as to the nature of this disease, as health officer, I have left no precautions unheeded to curtail and prevent the spread of the epidemic, and have been as guarded in all respects as if I had a contagious disease to contend with."

In his final report of an outbreak of diphtheria in the township of North Plains, Dr. C. S. Park, health officer, states:

"I believe there were several cases which recovered without a physician, and some cases in which an incorrect diagnosis was made before I was aware of the presence of the disease."

Another health officer writes concerning "colds and catarrhal sore throats, which some of our physicians will still call diphtheria."

MEASURES TAKEN TO RESTRICT DIPHTHERIA—RESULTS.

The following are representative statements of health officers who reported quite fully that they enforced strict isolation and thorough disinfection:

Dr. Lewis S. Walter, health officer of Fife Lake township, Grand Traverse county, in his final report of an outbreak of diphtheria, on Dec, 4, 1886, in his jurisdiction, states as follows concerning measures of restriction:

"The disinfectants used were for rooms, 3 lbs. of sulphur burned per 1000 cubic feet of air space: for clothing, boiling in sulphate of zinc; for discharges passed in the room, carbolic acid; for contents of privy vault, sulphate of iron. The patients were kept isolated from other people except nurse and physician."

J. F. Suydam, health officer of Alma, reports the measures of restriction taken in an outbreak of three cases and one death, in substance as follows:

"All rooms in the house, and also the privy, were fumigated by burning ten pounds of sulphur; disinfectant used for clothing was sulphate of zinc; for disinfecting the contents of the privy vault, 10 lbs. chloride of lime and 20 lbs. of copperas were used. The patients were kept isolated from other people except nurse and physician."

An outbreak of four cases and one death occurred in Montague, Muskegon county, in Sept. 1886. Concerning measures of restriction, Dr. L. E. Jones, health officer, reports as follows:

"Those infected with diphtheria were at once separated from the rest of the family as much as possible, house placarded, all excreta from patient placed in a solution of sulphate of iron in proportion directed [by the State Board of Health?], all clothing, etc., near the patient were subjected to boiling in a solution of zinc as directed. After recovery or death of the patient property was disinfected by burning sulphur as directed. In case of death, the funeral was strictly private and burial at once."

R. G. Cummings, M. D., health officer of Cadillac, reports measures taken to restrict diphtheria in his jurisdiction substantially as follows:

"Patients were kept isolated from all persons except nurse and physician. The disinfectants used were for rooms: burning 3 lbs. of sulphur per thousand cubic feet of air space, and the use of mercuric chloride, and chloride of lime, the whole house being disinfected from cellar to garret; for clothing, sulphate of zinc and common salt, as directed in circular 106 issued by the State Board of Health. Discharges were received in vessels containing copperas and zinc solution; 6 lbs. of chloride of lime and 10 lbs. of copperas were used in disinfecting contents of privy-vault."

Dr. Daniel M. Jones, health officer of Berlin township, St. Clair county, in his report of an outbreak states concerning restriction:

"Patients were isolated from other people except nurse and physician. Rooms and their contents were exposed to the fumes of burning sulphur at the rate of three pounds per thousand cubic feet of air space; clothing was disinfected in copperas and zinc solution, and the contents of privy-vault disinfected by five gallons of sulphate of iron."

Quite a number of health officers described at length thorough use of disinfectants; but, regarding isolation, simply reported: "house placarded," "sign put up," "notice given to the public," and similar statements, thus leaving it in doubt whether the public were prohibited from intercourse with the family, and whether the patient was isolated from all except nurse and physician. Also a large number reported isolation thoroughly enforced, but did not mention the use of disinfectants. A few stated that neither isolation nor disinfection were enforced, and quite a large number indicated that either one or the other was neglected. Also quite a large number were entirely silent on measures of restriction.

TRANSGRESSION OF HEALTH LAWS.

Dr. J. L. Mitchell, health officer of Jackson, in his report of an outbreak of diphtheria in his jurisdiction, states:

"On examining into the cause of this outbreak, I found the disease had been in progress from seventeen to twenty days without having been in any instance reported by the attending physician."

This transgression of the law was followed by some 40 cases and 8 deaths from diphtheria in that locality, and the disease was carried from there to Marshall, where 3 more deaths occurred, and it is probable that, if all the facts were known, still other outbreaks, with their baneful consequences, could be traced to Jackson as their source, and laid at the door of the physician who neglected his duty.

A. G. Cowles, M. D., health officer of Vernon township, Shiawassee county, reports an outbreak of 30 cases and 11 deaths. Concerning source of contagium and mode of spread, he stated in substance, that a Mr. Perry went into an adjoining township to nurse diphtheria. On returning he protested strongly against restriction; took his little girl, seven years of age, and kissed her. A few days later the father, the little girl, and four other members of the family were stricken with diphtheria, and two of them died.

W. K. Moore, health officer of Algonac, in reporting an outbreak in his jurisdiction, states as follows: "The cause of its continuance with us for such a long time was undoubtedly the impossibility of perfectly isolating the French. Among the poorer classes of this people it raged." The doctor reported 50 cases and 4 deaths in this outbreak.

Of an outbreak in Taylor township, Wayne county, in which there occurred 26 cases and 2 deaths, Frederick A. Shumann, supervisor, on Dec. 6, wrote in substance, as follows:

"Report has been this day made to me by the health officer of Taylor township that in a case of diphtheria at the house of Charles Reidle the health officer put up a placard notifying the public of the nature of said disease. Reidle, not wishing the notice to be there, tore it down. The public are very much excited over the matter. What shall I do in the premises?"

In reply the following letter was sent from this office:

"In reply to your letter of December 6, I send you by this mail a circular issued by this Board on the work of health officers, with marked paragraphs in a law answering the questions which you ask. It is the duty of the health officer, unless instructed by his local board to do otherwise, to give 'notice of infected place by placard on the premises,' and whoever violates the provisions of this act 'shall forfeit for each such offense a sum not exceeding one hundred dollars.'"

Dr. A. E. Wright, health officer of the township of Ecorse, Wayne county, writes, concerning an outbreak in his jurisdiction, that the attending physi-

cian did not report the outbreak until after the first death. In his final report of the first 18 cases and 7 deaths, the health officer makes no mention of using any disinfectants whatever. There were reported in this outbreak 85 cases and 15 deaths.

On Jan. 21, 1887, a report was received from J. D. Dunlop, M. D., health officer of Alpena, concerning an outbreak of diphtheria which occurred in that city Dec. 29, 1886. Regarding source of contagium, the following was stated: "It was conjectured that the first little boy contracted the disease while witnessing the removal of bodies to a new cemetery." Concerning this statement, a letter went from this office to the health officer, as follows:

"On your special final report of Jan. 18, relative to diphtheria, there is an interesting conjecture in regard to the source of contagium. If possible, will you have the kindness to answer the following questions:

"1. What is the age of the first boy taken with diphtheria?

"2. On what day did he witness the removal of the bodies from the cemetery; or, how long time after he witnessed the removal, to Dec. 29, when he was taken sick?

"3. Is it positively known that any bodies removed on that day, or other days, had died of diphtheria? Can this not be determined by the record of burials?

"4. If any one of the bodies had died of diphtheria, how long had it been buried?

"5. How near did the boy approach to any body, or to the open graves?

"6. Were any other children standing about witnessing the removals?

"7. If any bodies dead from diphtheria were removed, what precautions, if any, were taken?

"8. Was this child's father engaged in the work of removing the bodies?

"I would be glad to have as complete answers as possible to these questions. It might take a little time and patience, but something important might be learned.

"Any other information bearing upon this subject that you may learn I would be glad to get.

"In this investigation it is important to learn if there was any other way in which the boy *might* have contracted the disease than by exposure in the cemetery."

In reply, Dr. Dunlop stated in substance that the first child sick was a boy eight years of age; that it was positively known (the boy having so stated before his death) that he witnessed the removal of the bodies, one of which had died of diphtheria some eighteen months before. The doctor also states that the city council gave permission to remove the bodies without consulting the local board of health.

PRACTICAL RESULTS IN RESTRICTING DIPHTHERIA.

The following table and diagram exhibit some of the practical results of efforts at restricting diphtheria in Michigan during the year 1886. The table is compiled from the reports, letters, etc., of local health officers, and the diagram is constructed from the figures given in the table.

The first double (column marked "(1)" in the table) shows the average number of cases and the average number of deaths in all outbreaks* (excluding Detroit and Grand Rapids, where the disease was reported present each week throughout the year, and we have no knowledge of how many distinct outbreaks owing their origin to different sources of contagium occurred). The second double column gives the average number of cases and the average number of deaths in 243 outbreaks in which isolation and disinfection were not mentioned or concerning which the statements were of doubtful meaning.

* Whenever a break of sixty days or more has occurred in the progress of diphtheria it has hitherto been uniformly regarded as two different outbreaks, but in estimating outbreaks for this table, in those cases in which the second appearance of the disease originated from the first, the intermission was disregarded and it was treated as a single outbreak. This explains the apparent discrepancy between the number of outbreaks here given and the number given at the beginning of this article.

The third double column exhibits the average number of cases and the average number of deaths in the 102 outbreaks in which isolation or disinfection or both were neglected. The fourth double column shows the average number of cases and the average number of deaths in 116 outbreaks in which isolation and disinfection were both enforced.

TABLE.—*Diphtheria in Michigan in 1886: Exhibiting the Average Number of Cases and Deaths per outbreak:—(1) in all the 461 outbreaks reported, (2) in the 243 outbreaks in which it is doubtful whether or not Disinfection and Isolation were secured, (3) in the 102 outbreaks in which Isolation or Disinfection, or both, were neglected, and (4) in the 116 outbreaks in which Isolation and Disinfection were both enforced. Compiled in the office of the Secretary of the State Board of Health, from reports made by local health officers.*

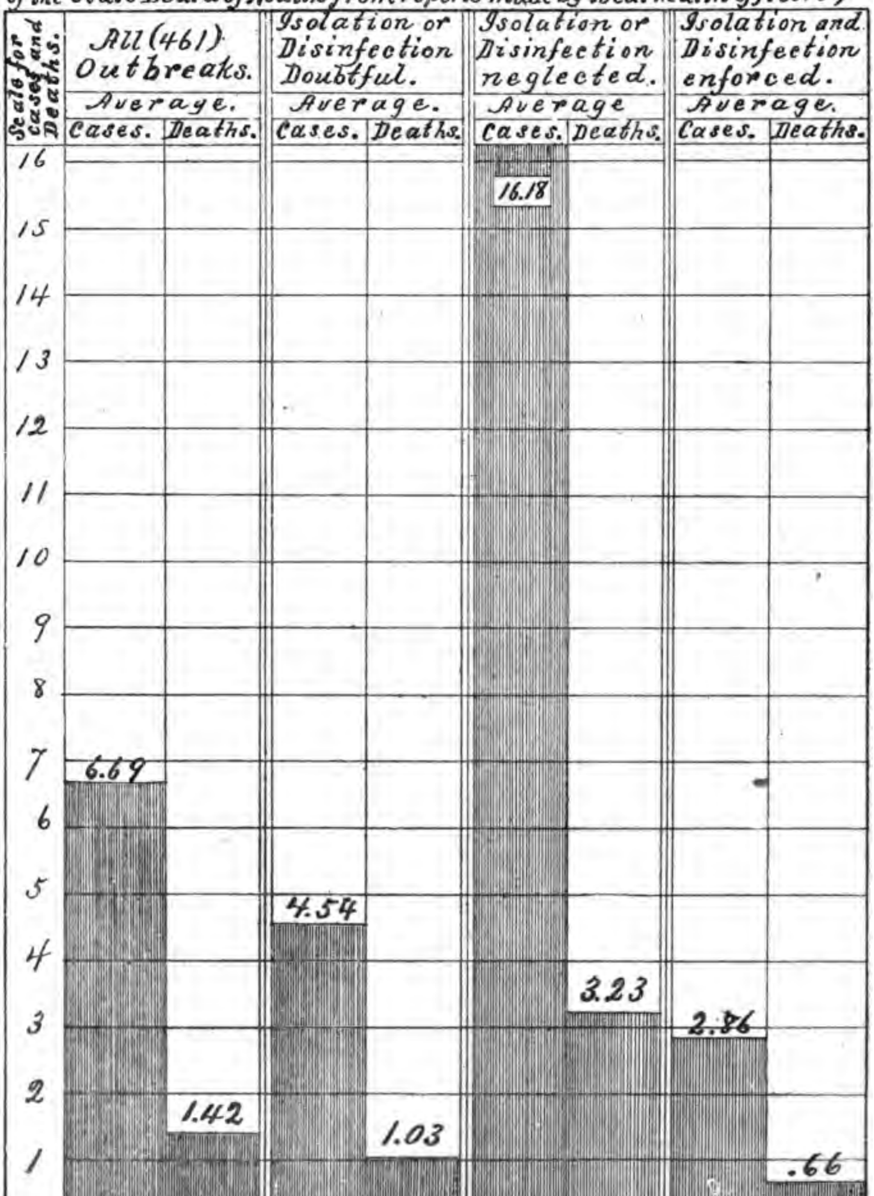
	(1.) All Outbreaks.* (461 Outbreaks.)		(2.) Isolation or Disinfection not Mentioned or Statements Doubtful.† (243 Outbreaks.)		(3.) Isolation or Disinfection or Both Neglected. (102 Outbreaks.)		(4.) Isolation and Disinfection Both Enforced. (116 Outbreaks.)	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Totals	3,085	656	1,103	250	1,650	329	332	77
Averages	6.69	1.42	4.54	1.03	16.18	3.23	2.89	.66

* These do not include the cases in Detroit and Grand Rapids.
† It is possible that in giving the public the benefit of the doubt, cases are sometimes reported diphtheria which ultimately prove otherwise. Many of these being limited to one or two cases may bring the averages in these columns, concerning which least is known, below what they really should be. All cases and deaths, concerning which positive statements were made by health officers, are included in the columns marked (3) and (4).

As shown in the table, all outbreaks reported were 461,* in which there were 3,085 cases and 656 deaths, making an average of 6.69 cases and 1.42 deaths per outbreak. In 243 outbreaks where isolation or disinfection were not mentioned, or the statements were of doubtful meaning, there were 1,103 cases and 250 deaths, making an average of 4.54 cases and 1.03 deaths per outbreak. Also, in 102 outbreaks in which isolation or disinfection or both were neglected there were 1,650 cases and 329 deaths, averaging 16.18 cases and 3.23 deaths per outbreak, while in 116 outbreaks in which isolation and disinfection were both enforced there were 332 cases and 77 deaths, or an average of only 2.86 cases and .66 deaths per outbreak, indicating a saving of 13.32 cases and 2.57 lives per outbreak, or 1,545 cases and 298 lives in the 116 outbreaks, by isolation and disinfection. Furthermore, if in all the 461 outbreaks there had been no restrictive efforts, and the averages had remained the same as in the 102 outbreaks in which we know isolation or disinfection was neglected, the total cases would have been 7,459 and the deaths would have been 1,489. Deducting the cases (3,085) and the deaths (656) which really occurred despite all the restrictive measures, and there is indicated a saving of 4,374 cases and 833 lives by these measures during the year 1886. Again, if isolation and disinfection had been enforced in all the 461 outbreaks and the averages had remained the same as in the 116 outbreaks in which we know isolation and disinfection were enforced, the total cases would have been 1,318 and the deaths would have been 274. Deducting these

* Outbreaks in Detroit and Grand Rapids are not included.

Diphtheria in Michigan in 1886, exhibiting the Average Numbers of Cases and Deaths per outbreak:—(1) in All the 461 outbreaks Reported, (2) in the 243 outbreaks in which it is Doubtful whether or not Disinfection or Isolation were secured, (3) in the 102 outbreaks in which Isolation or Disinfection or both were neglected, and (4) in the 116 outbreaks in which Isolation and Disinfection were both enforced. (Compiled in the office of the Secretary of the State Board of Health from reports made by local health officers.)



from the 3,085 cases and 656 deaths which occurred, there is indicated 1,767 cases and 382 deaths which resulted from the neglect of isolation and disinfection during the year 1886.

Thus the local boards and health officers who faithfully enforced restrictive measures have the satisfaction of knowing that their efforts have proved of solid advantage in preventing much sickness and many deaths, with their concomitant suffering and sorrow, and those who have hitherto been negligent of duty will find in this evidence eloquent exhortation to increased diligence.

EVIDENCE ON PERIOD OF INCUBATION.

Fifteen health officers stated that the period of incubation in diphtheria in their jurisdiction was from two to eight days; twelve others reported periods ranging from three to ten days; and eighteen reported periods ranging from three to fourteen days; others reported various periods, such as about nineteen days, ten to fifteen days, seven to eighteen days, and five to nineteen days.

The following are some of the more complete statements:

D. H. Wood, M D., health officer of Quincy, writes:

"The last case, and one that proved fatal, was a man twenty-two years of age. exposed by the loafer coming into his room on Monday and remaining two hours. On the following Thursday morning he was taken violently sick, and died early Wednesday morning following—making the period of incubation in this case three days; and I think there could be no clearer proof of the contagious nature of the disease."

W. K. Moore, M. D., health officer of Algonac:

"The period of incubation varied from two to eight days, and appeared to be governed by the previous health of the patient, sanitary surroundings, etc. The most severe cases had the shortest stage of incubation, and the more robust the patient and the better the sanitary conditions, the slower the disease incubated."

A. G. Cowles, M. D., health officer of Vernon township, Shiawassee county, reported as follows:

"The father came home from nursing the cases [of diphtheria] in July, and advocated strongly against restriction; took his little girl, seven years of age, and kissed her. The father and the girl came down the same day, August 7; the 12th, a boy thirteen years old came down; on the 13th another boy aged twenty-three was taken; on the 22d the mother was taken; and on the 23d another girl was taken—all of the same family and living in the same house; thus showing that the time is uncertain; it may be two days or two weeks."

Dr. A. A. West, health officer of Elk township, Sanilac county, states:

"The period varied. The second case occurred in four or five days; and the third, fourth and fifth cases not for two weeks, but on an average found it from three to ten days. Where the patient had been bilious previously, or where in any of them there had been anything to exhaust the system or impair the blood, it was much more readily developed and was of a more malignant type."

C. E. Chappell, health officer of Wight township, Ottawa county, writes as follows:

"The young man [who was infected with the disease] came home the 29th of November. On the 5th of December one case occurred, on the 6th one, and on the 9th one."

Dr. W. L. Garrett, health officer of Watervliet township, Berrien county, writes:

"The seven members of the family were all taken sick within a period of ten days, the first two on the same day and the other five within three days of each other. The eighth case in the family of a neighbor came in on the start to assist, and came down two weeks after the first exposure."

A. L. Carr, health officer of Weare township, Oceana county, states:

"There were six cases in John Seitz's family. The first case was taken November 27, second case December 4, third and fourth cases taken sick December 5, fifth case taken sick December 8, and sixth case taken December 10."

Dr. A. E. Wright, health officer of Ecorse township, Wayne county, writes:

"In the first family, the youngest was taken June 10, and died the 17th. Four others were taken sick the day of the funeral. Another family consisting of two boys, one died; the other was taken sick two weeks after. The period has varied from 7 to 14 days."

HOW LONG WILL DIPHTHERITIC CONTAGIUM REMAIN ACTIVE?

Henry O. Whelan, health officer of Deerfield township, Isabella county, writes concerning an outbreak in his jurisdiction on February 22, as follows:

"Originated from having the same disease there last fall. In the months of September and October last there were several cases and one death in the same family."

W. B. Hathaway, M. D., health officer of Bloomingdale township, Van Buren county, in his report of an outbreak which occurred in his jurisdiction on May 6, states:

"A young lady, aged 16 years, visited a neighbor whose family had suffered from the disease in November last; three cases and one death in that family were reported by me in my last report. This visitor caught the disease by handling the clothes of a deceased member of that family."

An outbreak occurred in Douglass township, Montcalm county, on July 29, concerning which Corydan Rice, the health officer, states:

"As near as I can learn the disease was contracted from the clothes of a boy who died with diphtheria about a year ago at a neighboring town. His clothes were brought home and worn this summer by one of his brothers, and he also died."

Dr. A. M. Martin, health officer of the township of Odessa, Ionia county, in his report of an outbreak on April 18, in his jurisdiction, states: "Supposed to have been contracted by the child staying over night at a house where they had diphtheria last fall."

Dr. O. Marshall of Lansing, on Sept. 22 reported a case of diphtheria which he attributed to infection which had remained in the house or about the premises for two years. To his knowledge there were two severe cases of diphtheria in this house two years ago.

One health officer stated: "A family moving in at next door lost a child about one year ago with diphtheria. Must have caught it from clothing of the deceased, which they brought with them." Another stated: "Case was where they had diphtheria in the family about two months before." Another health officer stated: "It was a recurrence of a former outbreak, and resulted from the uncleanliness of the back yard."

SCARLET FEVER IN MICHIGAN—YEAR ENDING DECEMBER 31, 1886.

By reference to pages 177–8, table 1 and exhibit 1, it will be seen that the average number of deaths per year from scarlet fever reported to the Secretary of State as having occurred in Michigan during the five years (1869–73) immediately preceding the organization of the State Board of Health, was much greater than for the eleven years (1874–84)* during which the State Board

* Statistics for 1885 and 1886 are not yet available.

has endeavored to restrict the disease. Allowing for increase of population, there is indicated a saving of 338 lives per annum ; and assuming the death-rate to be the same as the average death-rate in this disease, there is indicated the prevention of 3,380 cases of scarlet fever per annum in Michigan by restrictive measures.

Weekly and special reports at or near the beginning of outbreak, special final reports received at the close of outbreak, and the annual reports received at the close of the year, show that there were 368 outbreaks in 302 localities, 3,046 cases, and 275 deaths from scarlet fever in Michigan during the year ending Dec. 31, 1886. From this it may be seen that the deaths were 9 per cent of the cases, and that there were an average of 8.28 cases per outbreak.*

The map on page 217 exhibits the number of outbreaks, cases, and deaths from scarlet fever, and the number of localities in which they occurred in Michigan during the year ending Dec. 31, 1886. From this it is seen that from 15 of the 82 counties in the State no cases of scarlet fever were reported. These 15 counties are as follows: Alger, Isle Royal, Baraga, Ontonagon, Mackinac, Iron, Manitou, Montmorency, Benzie, Iosco, Ogemaw, Roscommon, Missaukee, Gladwin, and Newaygo. These are mostly new and sparsely populated counties in which there is not rapid and easy railroad or other means of communication which in other counties seem to spread contagious diseases. It may be seen, also, that four counties reported 1,629 cases, or more than all the other counties combined. These four counties, in the order of the greatest number of reported cases, are as follows: Wayne, 1,235; Kent, 161; Kalamazoo, 132 ; and Macomb, 101 cases.

SCARLET FEVER IN 1886 COMPARED WITH 1885.

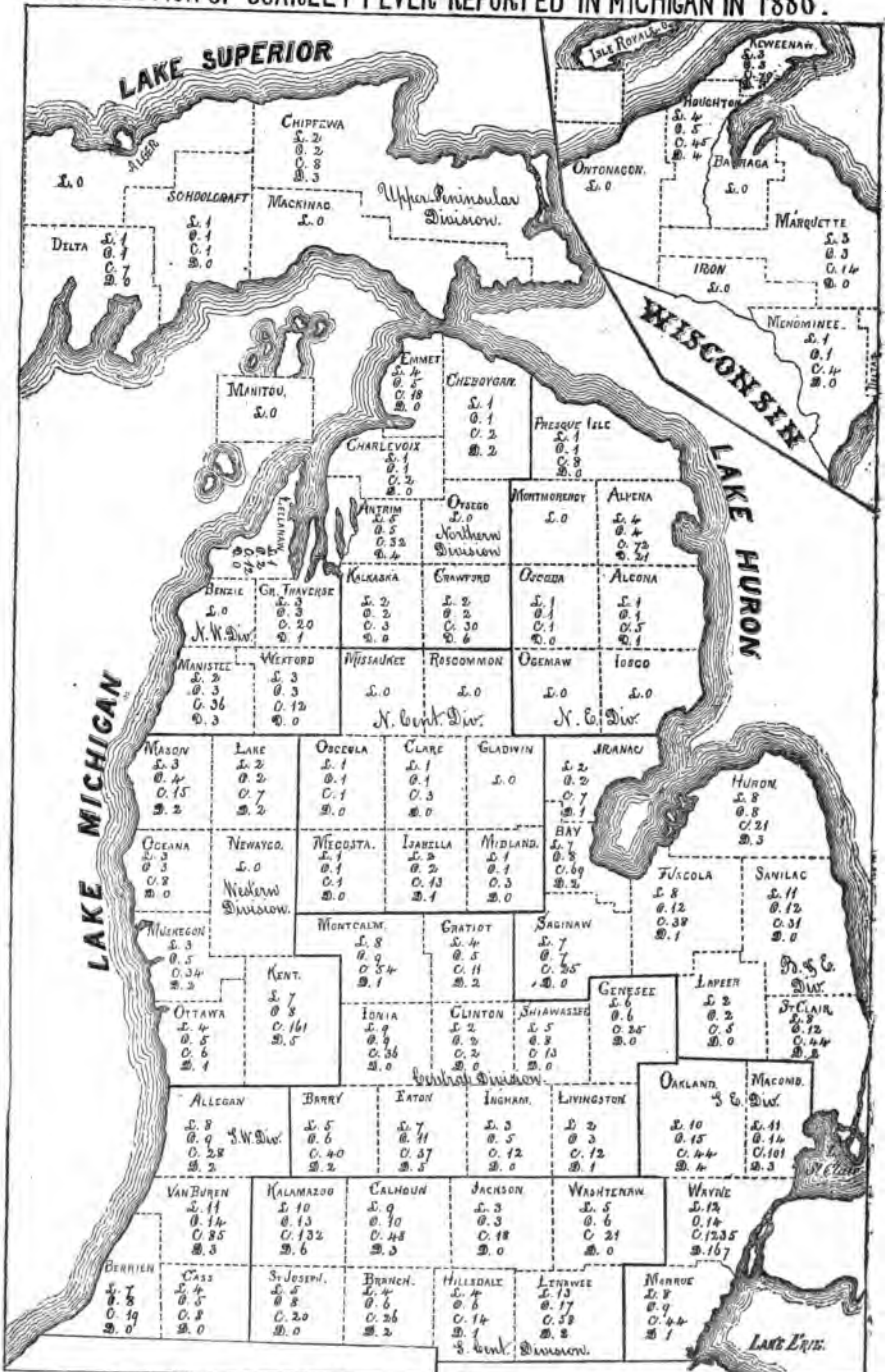
Comparisons with former years are not so satisfactory as they would have been had the reports of past years been as extensive and thorough as those of the present year. In 1886, as already seen, there were reported 368 outbreaks in 302 localities, 3,046 cases, and 275 deaths, the per cent of deaths to cases being 9, and the average number of cases per outbreak, 8.28. For the year 1885 there were reported 356 outbreaks in 337 localities, 2,750 cases, and 287 deaths, the per cent of deaths to cases being 7, and the average number of cases per outbreak being 8. The 12 more outbreaks, 298 more cases, and 88 more deaths reported in 1886 than in 1885 is probably due to more perfect reports in 1886, instead of to a greater amount of scarlet fever during that year, for the card reports indicate that scarlet fever was 1 per cent less in 1886 than in 1885. The system of the State Board for obtaining reports is steadily improving from year to year, and it is believed that health officers and local boards of health are becoming more and more alive to the importance of thorough reports; hence it seems probable that a greater per cent of the outbreaks, cases, and deaths which occur is reported each year than was reported in the preceding year.

SOURCE OF CONTAGIUM IN SCARLET FEVER.

In the reports of 116 of the 324 outbreaks, the source of contagium was not mentioned; in 114 it was reported "unknown;" and in the remaining 94

*The reasons for the difference between this average and the average shown in a table and diagram further on is explained in a foot note in connection with the diagram and table.

DISTRIBUTION OF SCARLET-FEVER REPORTED IN MICHIGAN IN 1886.



L. = Localities. O = Outbreaks. C. = Cases. D. = Deaths.

outbreaks the disease was reported as having been traced either to its source or to its probable source. Of these 94 outbreaks 2 were reported "sporadic;" 4 from "contagium;" 5 were attributed to filth or unsanitary conditions; 13 were reported as probably derived from former cases of scarlet fever; and the remaining 70 outbreaks were reported as having been traced to former cases of the disease.

Seventy Outbreaks Traced to Former Cases.

The following reports of health officers indicate that the outbreaks in their respective jurisdictions were produced by contagium from scarlet fever cases:

Concerning an outbreak in Isabella township, Isabella county, Edward F. Wood, health officer, states as follows:

"A woman brought the disease from Canada in her clothing, and gave it to the children where she stayed. Case No. 1 took it then, and case No. 2 took it from the children at school."

Dr. J. P. Cooper, health officer of Ithaca township, Gratiot county, writes concerning an outbreak in his jurisdiction as follows:

"The only source of contagium that I have been able to discover was through letters received from a family residing in Mt. Pleasant which was then affected with it."

F. P. McCormick, M. D., health officer of Alcona township, Alcona county, reports concerning source of contagium in an outbreak in his jurisdiction as follows:

"The parties were away visiting and were there exposed. First case brought from Montreal, Canada."

Regarding the source of contagium of an outbreak of scarlet fever in Texas township, Kalamazoo county, A. R. Martin, M. D., health officer, states:

"A relative of the family, where the first case occurred, is supposed to have brought the infecting germs in his clothing from Kalamazoo, where he had been visiting."

James H. Shepherd, health officer of Dover township, Lenawee county, reports concerning an outbreak in his jurisdiction as follows:

"Infected clothing. The disease has broken out nearly every year in one quarter of my township, or within a circle of three miles. Think clothing has never been properly disinfected."

The following are statements of health officers concerning source of contagium of outbreaks in their respective jurisdiction, with the name of locality and health officer subjoined:

"The children had been visiting where other children had a rash that was said to be caused by teething or heat. There were several cases of the kind near Minden City, Sanilac county, where the children were visiting."—*W. L. Schoales, M. D., health officer, White Rock township, Huron county.*

"Probably from the city of Marshall, as the children were in the habit of going by a house that was placarded 'scarlatina' on their way to and from school. The second family received the contagium from Mr. Westfall's, in Sheridan township. In the third I have no idea where it came from."—*William N. Case, M. D., health officer, Marengo township, Calhoun county.*

"It was carried from the adjoining township, where there have been several cases."—*Ezekiel Gerow, health officer, Ossineke township, Alpena county.*

"A family moved here from an infected district, and their children came in contact with the children of this family at school."—*James Adams, health officer, Adams township, Arenac county.*

"Introduced into this place by a family from Bay City."—*Frank E. Abbott, M. D., Clerk, Deep River township, Arenac county.*

"A young lady from Grand Rapids called at the house and stayed about three hours, just after recovery from sore throat and ague."—*Dr. John W. Cooper, health officer, Wyoming township, Kent county.*

"Two young people from a neighborhood infected with scarlatina in Hillsdale county came to visit the family, where the case reported occurred, a few days before she was taken sick."—*Dr. J. D. Ely, health officer, Medina township, Lenawee county.*

"By the presentation of the dress of a little girl who died at Jackson to a little girl living here."—*Dr. Samuel DuBoise, Unadilla township, Livingston county.*

"A man came in this place, and stayed over night, who had had it in his family in Monroe township."—*L. C. Read, M. D., health officer, Sandusky village, Sanilac county.*

"In one case, not known; in the other, from contact in one of the outlying townships of this county."—*Dr. A. J. Robb, health officer, Owosso.*

"Direct exposure to the disease while on Walpole Island, where the disease was present in some Indian families."—*Dr. W. K. Moore, health officer, Clay township, St. Clair county.*

"By a visiting sister in Sturgis township who, it is supposed, carried the disease in her clothing and communicated the same to the rest of the family."—*Dr. Robert Gillispie, health officer, Fawn River township, St. Joseph county.*

"From the mother of the children who was exposed to scarlatina at Orion, and came down with the fever about one week after returning home."—*J. M. Burgess, M. D., health officer, Northville.*

"Imported from adjoining township"—"Scholars from an adjoining township attending school; one taken sick in schoolroom."—*James M. Kress, health officer, Bridgewater township, Washtenaw county.*

"In four cases conveyed in clothing from Gaines; others not known."—*C. C. Blanchard, M. D., health officer, Linden.*

"I think it was brought here from Walts, Mich., last fall, and has at times been troubling us ever since."—*Dr. John M. Truscott, health officer, Wayne.*

The following are very brief statements of health officers concerning source of contagium, the names of localities and health officers being omitted:

"By myself attending funerals as minister." "Taken from another person." "In room infected." "Exposure in another township." "Exposure in an infected district." "At house of E. French." "Contracted in Chicago." "From Union City." "From other persons." "Brought in from adjoining county." "From the country." "Direct contagion." "Brought here from Holly." "Exposure." "Little girl was exposed at Utica." "From school teacher." "Detroit." "Exposure at Adrian." "Exposure while in Detroit." "Contracted at Whitehall." "Ludington city." "From attending a scarlet fever family at Monroe." "From Nebraska." "Brought from Toledo, Ohio." "From direct exposure in adjoining jurisdiction." "From his brother—reported last year." "Brought from Iowa." "Was contracted at church in Posen." "From Macomb county." "Exposure." "On R. R. train." "From Smith's Creek, Mich." "Exposure by contact." "Brought from Illinois." "Contracted at Lansing." Five health officers stated that the disease was caught by visiting; six attributed the disease to "infected clothing;" two stated that it was caught "at school."

Thirteen Outbreaks Probably Traced to Former Cases.

"Supposed to have been contracted from cases at Alma, Mich., yet I could only prove it indirectly."—*W. B. Anderson, M. D., health officer, Pine Grove township, Van Buren county.*

"Believed to have been infected from the next township."—*Hugo Schreiber, health officer, Grove township, Crawford connty.*

"Is not known with certainty; but I think it was probably introduced by persons passing to or from Detroit where the disease was reported as prevailing."—*Dr. T. H. Matthews, health officer, Redford township, Wayne county.*

"Brought from Detroit, as supposed, by clothing not properly fumigated and disinfected."—*H. L. Bower, M. D., health officer, Greenville.*

"Friends visiting from Chicago the past summer, and leaving a quantity of clothing which probably had belonged to convalescents from the fever."—*Hugh Kilpatrick, health officer, Carp Lake.*

"There were two or three cases here last year and some the year before. This is the only known source of contagium."—*A. Judson Collar, M. D., health officer, Ellsworth township, Lake county.*

"Supposed to come from Royal Oak, the adjoining township, where there have been cases of scarlet fever."—*Dr. J. L. Campbell, health officer, Birmingham.*

"The parents went to a camp-meeting, and while there the child came down with scarlet fever."—*James W. Goodfellow, health officer, Venice township, Shiawassee county.*

"As near as I could find out it was brought here by the parents of a young child who had the disease previous to coming here."—*L. W. Lyon, M. D., health officer, Port Sanilac.*

"Supposed to have been brought here by visitors from abroad."—*R. C. Traver, M. D., health officer, Somerset township, Hillsdale county.*

Other health officers stated: "Probable source, Grand Rapids." "Believed to have come from Bay City." "Prevalent here some months before."

Five Outbreaks Attributed to Unsanitary Conditions, etc.

"I can charge it to no other source than very bad weather and wet land."—*Henry B. Dunn, health officer, Ellington township, Tuscola county.*

"All in one family. Probably impure water."—*M. H. Sweet, health officer, Grant township, Oceana county.*

"Insufficient sewerage."—*Dr. J. W. Caughlin, health officer, Bay City.*

"Foul privy vault."—*Dr. L. A. Warsabo, health officer, Coldwater.*

"Malaria."—*Dr. W. A. Calkins, health officer, Woodbridge township, Hillsdale county.*

MEASURES TAKEN TO RESTRICT SCARLET FEVER—RESULTS.

The following are representative statements of health officers who reported quite fully that they enforced strict isolation and thorough disinfection:

C. E. Walters, M. D., health officer of Whitehall, in his final report of an outbreak of scarlet fever on Dec. 2, 1886, in his jurisdiction which was limited to three cases and no deaths, states substantially as follows concerning measures of restriction:

"I gave notice of infection, also, to the people by notice in the village paper. Patients were kept isolated from other people except nurse and physician. The disinfectants used were: for discharges pased in the room, chlorate of lime; for contents of privy-vault, lime and sulphur; and all rooms in the house from cellar to garret were exposed for 24 hours to the fumes of burning sulphur at the rate of 2 pounds per 1,000 cubic feet of air space."

On Oct. 19, 1886, an outbreak occurred in North Muskegon in which there were but 2 cases and no deaths. G. C. Havens, M. D., health officer, writes as follows concerning measures of restriction:

"The patients were kept isolated from other persons except nurse and physician. The disinfectants used were: for clothing, boiling in a solution of sulphate of zinc; for contents of privy-vault, 2 pounds of sulphate of copper; discharges from the bowels and bladder were received in a solution of sulphate of copper, and all the rooms in the house were, with closed doors and windows, exposed to the fumes of burning sulphur at the rate of 3 pounds of sulphur per 1,000 cubic feet of air space."

B. M. Hutchinson, M. D,, health officer of Lyons, in his final report of an outbreak in his jurisdiction, states in substance as follows concerning measures of restriction:

"Patients were kept absolutely isolated from all persons except nurse and physician. The disinfectants used were: for clothing, immediate cleansing with lime water and chlorides; for contents of privy-vaults, sulphate of iron and chloride of lime; discharges passed in rooms were buried, and all rags, etc., used were burned. All rooms were fumigated with sulphur at the rate of one pound per 1,000 cubic feet of air space."

F. W. Graham, M. D., health officer of Ludington, in his final report of an outbreak on November 16, which was limited to one case, writes as follows concerning measures taken to restrict the disease:

"Premises were placarded and house quarantined. The disinfectants used were: for clothing, sulphur fumes and mercuric bichloride solution; for discharges passed in the room, copperas; for contents of privy-vault, copperas and chloride of lime. The rooms were disinfected with fumes of burning sulphur at the rate of two and a half pounds per 1,000 cubic feet of air space."

An outbreak of scarlet fever occurred in Pontiac on Nov. 13, 1886, which was limited to one case. Dr. Mason W. Gray, health officer, reports measures of restriction substantially as follows:

"The house was quarantined and the patient was kept isolated from all except nurse and physician. The disinfectants used were: for clothing, boiling in zinc solution; and the rooms were disinfected with the fumes of burning sulphur."

Dr. M. A. Jerome, health officer of Fairfield township, in his report of an outbreak in his jurisdiction in which there was but one case, gives the measures of restriction in substance as follows:

"Placarded the premises, put the patient in a room by herself and kept her isolated from all persons except nurse and physician. The clothing was disinfected in a boiling zinc solution, the discharges passed in the room were disinfected with chloride of lime and lightly buried, and all rooms in the house were fumigated with burning sulphur."

Quite a number of health officers described at length a thorough use of disinfectants; but regarding isolation simply reported "house placarded," "sign put up," "notices given to the public," and similar statements, thus leaving in doubt whether the public were prohibited from intercourse with the family, and whether the patient was isolated from all except nurse and physician.

Also a large number reported isolation thoroughly enforced; but did not mention the use of disinfectants. A few stated that neither isolation nor disinfection was enforced, and quite a large number indicated that either one or the other was neglected. Also quite a large number were entirely silent on measures of restriction.

TRANSGRESSION OF HEALTH LAWS.

D. H. Cole, M. D., health officer of Memphis and township of Riley, reports an outbreak of scarlet fever in his jurisdiction, stating concerning measures of restriction as follows: "Many families are so situated that it is next to impossible to separate the well from the sick. Besides the disease has been so mild in its type that many of the people came to feel very indifferent in regard to it." Again he writes: "Many of the cases have occurred without my knowledge till it was over. The disease has been so mild that of late I have not been anxious about it." It is worth remarking that in that vicinity alone 35 cases and two deaths occurred, and it is impossible to state how many outbreaks in other localities owe their origin to this lax attitude toward health regulations.

An outbreak occurred in Alamo township, Kalamazoo county, when, it appears, no health officer had yet been appointed. Dr. Paul T. Butler, M. D., who was finally appointed health officer, writes as follows:

"I had in all 51 cases of scarlet fever in this township, not one of them having contracted the disease after I enforced isolation, which I was not able to do until I had been appointed health officer. The manner in which I secured satisfactory isolation consisted in confining each fever patient

to the house where taken with the disease, until I saw fit to grant a permit to leave, and this was not given until desquamation had occurred and both house and patient had been thoroughly disinfected. No inmate of any house containing a scarlet fever patient was permitted to go out without being disinfected as to his clothing, hair, beard, etc. The results were so remarkably satisfactory that the public will be with me in the future."

J. D. Dunlop, M. D., health officer of Alpena, made a report of an outbreak of scarlet fever in his jurisdiction, stating: "It should have been reported before, but a great deal of difficulty has been experienced in getting a board to act, owing to so much abuse having been heaped upon them last year." In this outbreak there were reported as having occurred 52 cases and 16 deaths.

Dr. W. B. Andrews, health officer of Pine Grove township, Van Buren county, reports an outbreak of scarlet fever in his jurisdiction in which he states: "I should have reported sooner, but the physicians in attendance failed to report them to me." Again he states: "I have not had full particulars, but the physicians in attendance have taken full precautionary measures."

From this it appears that the attending physicians transgressed the law by not reporting cases to the local health officer immediately after they discovered them. It also seems that the health officer trusted the enforcement of restrictive measures to the care of the attending physicians, instead of rigidly enforcing them himself in person according to law.

PRACTICAL RESULTS IN RESTRICTING SCARLET FEVER.

The following table and diagram exhibit some of the practical results of the efforts at restricting scarlet fever in Michigan during the year 1886.

The table on page 223 is compiled from the reports, letters, etc., of local health officers, and the diagram is constructed from the figures given in the table.

The first double column, marked "(1)" in the table, shows the average number of cases and the average number of deaths in all outbreaks* (excluding Detroit and Grand Rapids, where the disease was reported present each week during the year, and we have no knowledge of how many distinct outbreaks owing their origin to sources of contagium occurred). The second double column gives the average number of cases and the average number of deaths in 221 outbreaks in which isolation and disinfection were not mentioned, or concerning which the statements were of doubtful meaning. The third double column exhibits the average number of cases and the average number of deaths in the 45 outbreaks in which isolation and disinfection or both were neglected. The fourth double column shows the average number of cases and the average number of deaths in 58 outbreaks in which isolation and disinfection were both enforced.

* Whenever a break of 60 days or more has occurred in the progress of scarlet fever it has hitherto been regarded as two different outbreaks, but in estimating outbreaks for this table and the corresponding table for diphtheria, if the second appearance of the disease originated from the first the intermission was disregarded and it was treated as a single outbreak.

TABLE.—*Scarlet Fever in Michigan in 1886: Exhibiting the Average Number of Cases and Deaths per outbreak:—(1) in all the 324 outbreaks reported, (2) in the 221 outbreaks in which it is doubtful whether or not Disinfection and Isolation were secured, (3) in the 45 outbreaks in which Isolution or Disinfection, or both, were neglected, and (4) in the 58 outbreaks in which Isolation and Disinfection were both enforced. Compiled in the office of the Secretary of the State Board of Health, from reports made by local health officers.*

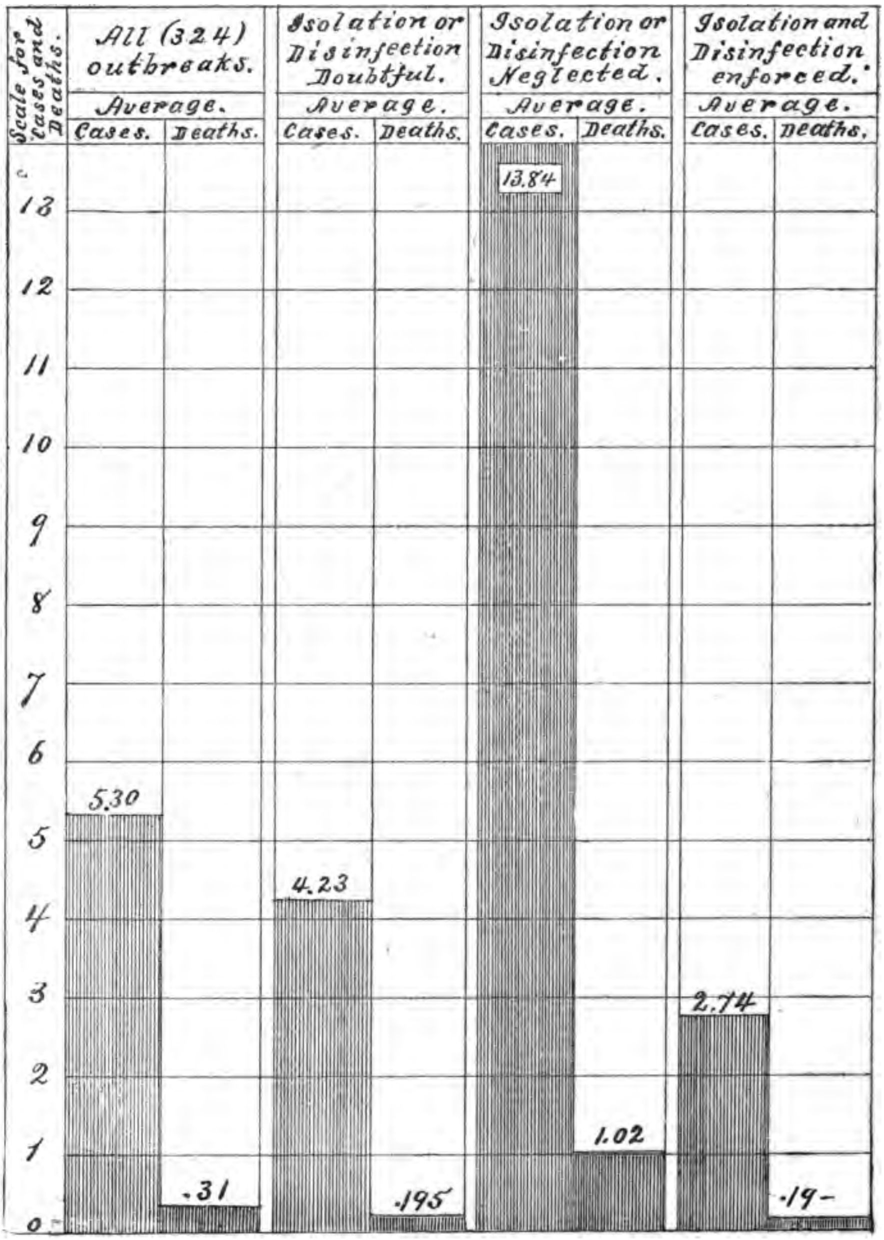
	(1.) All Outbreaks. (324 Outbreaks.)		(2.) Isolation or Disinfection not Mentioned or Statements Doubtful. (221 Outbreaks.)		(3.) Isolation or Disinfection or Both Neglected. (45 Outbreaks.)		(4.) Isolation and Disinfection Both Enforced. (58 Outbreaks.)	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Totals	1,716	100	934	43	623	46	159	11
Averages	5.30	0.31	4.23	0.195	13.84	1.02	2.74	0.19—

As shown in the table, all outbreaks reported were 324,* in which there were 1,716 cases and 100 deaths, making an average of 5.30 cases and .31 deaths per outbreak. In 221 outbreaks where isolation or disinfection were not mentioned, or the statements were of doubtful meaning, there were 934 cases and 43 deaths, making an average of 4.23 cases and .195 deaths per outbreak. Also, in 45 outbreaks in which isolation or disinfection or both were neglected there were 623 cases and 46 deaths, averaging 13.84 cases and 1.02 deaths per outbreak, while in 58 outbreaks in which isolation and disinfection were both enforced, there were 159 cases and 11 deaths, or an average of only 2.74 cases and .19- deaths per outbreak, indicating a saving of 11.10 cases and .83 lives per outbreak, or some 638 cases and 49 deaths in the 58 outbreaks by isolation and disinfection. Furthermore, if in all the 324 outbreaks there had been no restrictive efforts, and the averages had remained the same as in the 45 outbreaks in which we know isolation or disinfection was neglected, the total cases would have been 4,484, and the total number of deaths would have been 330. Deducting the cases (1,716) and the deaths (100) which really occurred despite all the restrictive measures, and there is indicated a saving of 2,768 cases and 230 lives by these restrictive measures during the year 1886. Again, if isolation and disinfection had been enforced in all the 324 outbreaks and the averages had remained the same as in the 58 outbreaks in which we know isolation and disinfection were enforced, the total cases would have been 888, and the total deaths would have been 61. Deducting these from the 1,716 cases and 100 deaths which occurred there is indicated 828 cases and 39 deaths which resulted from the neglect of isolation and disinfection during the year 1886.

For the local boards and health officers who faithfully and vigorously enforced restrictive measures, the above showing of their preventing sickness and saving life is good cause for congratulation, and those who were negligent of duty will find in this evidence powerful exhortation to diligence in preventing and restricting this disease in the future.

* The outbreaks in Detroit and Grand Rapids are not included in this number.

Scarlet fever in Michigan in 1886: The Average Numbers of Cases and Deaths per outbreak:—1, in all the 324 outbreaks reported; 2, in the 221 outbreaks in which it is doubtful whether or not Disinfection or Isolation were secured; 3, in the 45 outbreaks in which Isolation or Disinfection or both were neglected; and 4, in the 58 outbreaks in which Isolation and Disinfection were both enforced. (Compiled in the office of the Secretary of the State Board of Health from reports made by local health officers.)



PERIOD OF INCUBATION OF SCARLET FEVER.

There is much difficulty in determining the exact period of incubation of scarlet fever. Often the exact date of exposure is uncertain, and, if the time of exposure is known, the poison may be carried in the clothing or hair for some time before it becomes introduced into the system. Also in this disease the primary fever is sometimes so slight as to escape notice.

Thirty-two health officers made more or less definite statements regarding period of incubation. The following are reports of eight health officers concerning the period of incubation, with the names of health officers and localities subjoined:

"The only facts concerning incubation are: the first case occurred four days after receiving the letter [which was from a family then afflicted witn the disease]."—*Dr. J. P. Carpenter, Ithaca.*

"Eva Douglas was taken in school January 9. Cora Brown sat in the same seat with Eva, and chewed gum which Eva had been chewing. Cora came down with the disease January 10. The next case occurred 5 days after exposure. Of the other cases which followed, nothing definite could be learned."—*Dr. A. S. Martin, Texas township, Kalamazoo county.*

"Second case occurred about one week after the first, and about 7 to 9 days after the exposure."—*Dr. C. E. Bailey, health officer, Berlin township, Ionia county.*

"About six days after young Tafts [who brought the contagium] returned home the first case occurred; in the case of the others who could be traced from the same source the period was about eight days."—*Dr. Wm. Greenshield, health officer, Bruce township, Macomb county.*

"Two cases followed, the first case in five days, and the last case two days later."—*Dr. D. L. Parker, health officer, Marine City.*

"Not certainly known, but as near as they could judge, it was about 6 or 7 days from the visit of a young woman from Sturgis township, who they supposed carried the disease in her clothing, and by nursing the child conveyed the same to it."—*Dr. R. I. Gilespie, health officer, Fawn River township, St. Joseph county.*

"Andrew Von Wagoner was exposed at Albrants, and came down with scarlet fever in eight days." —*Henry B. Dunn, health officer, Ellington township, Tuscola county.*

"If the first case infected the rest, the longest period of incubation could have been 21 days; the shortest only a very few days."—*Dr. Willard Weller, health officer, Washington township, Gratiot county.*

Twenty-four other health officers made brief statements concerning the period of incubation, the substance of which is covered by the following: Six health officers reported periods within the limits of 2 to 7 days; nine gave periods ranging within the limits of 7 to 10 days; seven gave periods within 4 to 14 days; one stated that the period was about 20 days; and one that it ranged from 3 to 21 days.

SMALL-POX IN MICHIGAN—YEAR ENDING DECEMBER 31, 1886.

During the year ending December 31, 1886, there were reported 4 outbreaks of small-pox in 4 localities in Michigan, in which there were 24 cases and 7 deaths. During the previous year there were reported 9 outbreaks in as many localities, 27 cases, and 6 deaths. A report of the outbreaks during the year 1885, introduced by a very brief outline of the ravages which this disease has made upon the human race, may be found on pages 263–272 of the report for that year.

The following table exhibits the localities where small-pox was reported, the numbers of cases and deaths in each outbreak, the period of incubation, and the dates when the first and last cases occurred, as reported by the health officers.

TABLE.—*Stating the localities where Small-pox was reported during the year 1886, the number of cases and deaths in each outbreak, the period of incubation, and the month and day of month when the first and last cases occurred.*

Localities.	Cases.	Deaths.	Period of Incubation.		First Case.	Last Case.
			Shortest.	Longest.		
Pickford Tp., Chippewa Co.	8	3	11 days	21 days	June 1	July 8
Solon Tp., Kent Co.	*1	0	Unknown	Unknown	About Aug. 20	About Aug. 20
Redford Tp., Wayne Co.	1	0	Between 13 and 15 days	Between 13 and 15 days	May 30	May 30
Detroit, Wayne Co.	†14	4	Not reported	Not reported	‡ June 26	§ Dec. 11
Four localities	‖24	7	11 days	21 days	May 30	§ Dec. 11

* Case of varioloid.
† One case of varioloid is included in this number.
‡ Diagnosed small-pox on June 26, but was taken sick several days before.
§ Week ending Dec. 11.
‖ This number includes 2 cases of varioloid.

In only one outbreak did the disease spread beyond the first family, and in one-half of the outbreaks there was only a single case.

From the table it will be seen that Michigan was free from small-pox during January, February, March, April and 29 days of May; also from Dec. 11 to 31.

The source of contagium, measures of restriction and prevention, etc., are detailed in connection with each outbreak.

A CASE OF VARIOLOID AT GRAND RAPIDS.

Sept. 3 word was received at this office that a case of small-pox was discovered in Grand Rapids on Sept. 2, and that the patient had mingled freely with the public, although the disease was well advanced.

Concerning Source of Contagium and Measures of Restriction.

A letter of the usual form in such cases was at once sent to H. S. Holden, M. D., health officer of Grand Rapids, further requesting him to send a statement of the facts relative to the antecedents of the small-pox patient and to the source of contagium. Dr. Holden replied on Sept. 7 as follows:

"I have delayed answering in hopes to be able to trace the origin, or by what means the patient contracted the disease. So far am yet in the dark; but believe it must have been from infected clothing. The circumstances are as follows: Frank Skimmerhorn, age 28 years, whose father lives two and a half miles west of our city, called at police headquarters on the evening of Sept. 1, and asked for lodging, which was granted, and on the morning of Sept. 2 he went to the office of the director of the poor to solicit aid. There he found Dr. Wilson, member of the board of health, who discovered his disease to be small-pox, and from that time to this he has been in our hastily prepared pest-house. His history is this: He had been on a farm in the township of Paris, this county, for some two months or more when he changed and went to the town of Solon * in the north part of our county, and had been working there two weeks when he was first taken sick with chill and pain in back part of the head. He called on a physician, who prescribed for him. In two or three days the eruption appeared. He then visited the same physician who pronounced it a case of

* Dr. Holden gave it as the township of Tyrone; but it was later learned that he worked just over the line in the township of Solon.

poisoning from sumach or ivy, and gave him some copperas solution to bathe parts covered with the eruption. After remaining there four days after the eruption appeared, he came to our city, staying the principal time during the day around the hay market, and at night going to his father's barn to sleep. Says he was present part of the day at the democratic congressional convention which was held on the 1st of September, and which was attended by delegates from Allegan, Ottawa Ionia and Kent counties. * * * His case is a well marked case of varioloid."

Word was received from D. C. Lyle, clerk of the township of Solon, which confirmed the report of Dr. Holden so far as relates to the patient before he reached Grand Rapids. Documents on the prevention and restriction of small-pox were at once sent to Mr. Lyle, together with a letter urging immediate vaccination of all persons exposed, and that free vaccination be offered to the public by the board of health. There were no further cases reported in Solon township or Grand Rapids.

OUTBREAK OF SMALL-POX AT DETROIT.

On June 30, 1886, a letter was received from W. H. Rouse, M. D., of Detroit, reporting an outbreak of small-pox in that city, the first case having occurred June 26, 1886. This report was confirmed by the weekly report of Dr. O. W. Wight, health officer of Detroit.

Source of Contagium.

Concerning source of contagium the Detroit Evening News, of June 26, gives the following:

"A week ago Dr. Otto Lang, of Miami avenue, was called to attend a case of sickness in the family of a German machinist named Brandt, at 87 Waterloo street. The family, consisting of father, mother, a boy of 10 years and an infant of 2, had just returned from a visit to Germany. Dr. Lang diagnosed the sickness of the infant and pronounced it to be measles; several days ago he concluded that he had been mistaken and began treating it for chicken-pox. This morning when he called he was horrified to find that the little one's sickness had developed into the pustular state of small-pox. He informed Health Officer Wight, who immediately went to the house, and at once recognized the disease to be confluent small-pox in its most contagious form. Dr. Wight thinks the child must have caught the disease on shipboard and brought it home. He says that there has been a great deal of exposure, and it is possible that the dreadful disease may have been carried about and will make its appearance elsewhere."

Information as to whether or not this family came up the St. Lawrence has not reached this office.

Measures of Restriction.

There being no hospital for contagious diseases, it was decided to quarantine the patients at their homes. The Detroit Evening News states, regarding the first case, as follows:

"Dr. Wight took immediate steps to isolate the case. The house was quarantined and placarded, and the father compelled to come home from his work in a machine shop at the foot of Chene street. The family were vaccinated, as also were the people living in the adjoining houses."

The outbreak ended during the week ending Dec. 11. In this outbreak there were reported 14 cases and 4 deaths.

A CASE OF SMALL-POX IN REDFORD TOWNSHIP, WAYNE COUNTY.

On June 5, 1886, a report was received from Dr. T. H. Matthews, health officer of the township of Redford, Wayne county, stating that there was a case of small-pox in his jurisdiction.

Source of Contagium.

In his final report Dr. Matthews states as follows: "The patient came into this township on the 24th day of May from Germany. She came through Canada between the 15th and 18th (May) over the G. T. R. R., and thinks she must have been exposed to the contagion at that time." In a letter received later the Doctor states: "Her recollection of dates and places seems confused and indefinite. She states that she left Hamburg, May 2, on the Hamburg and American ship company's boat Wieland, arrived at New York on the 15th or 16th. Says she left there immediately for Detroit, and now thinks that she came from the suspension bridge over the G. W. R. R. instead of the G. T. as at first stated. She arrived in Detroit on May 20, and at Redford about the 25th, 1886." The Doctor also states that the woman was stricken with small-pox on May 30. Now by reference to the outbreak at Pickford, Chippewa county, at the close of this article, it will be seen that the first case occurred on June 1, and that at about the same time six other outbreaks occurred, all of which are traced to some infected Russians who came up the St. Lawrence. The development of this case at Redford corresponding in time so exactly with the others, and the woman having been along the route which those Russians took, it seems probable that she was infected by them.

Measures of Restriction—Result.

Dr. Matthews, in his final report of July 20, 1886, says that measures for the prevention of the spread were taken as follows: "Isolation, thorough use of disinfectants, notices to the public, and immediate vaccination of persons supposed to have been exposed." There was but this one case.

OUTBREAK IN THE TOWNSHIP OF PICKFORD, CHIPPEWA COUNTY.

On June 11, 1886, a letter was received at this office from Dr. A. E. Bacon, health officer of Sault Ste. Marie, reporting a case of small-pox at Stalwart, Pickford township, Chippewa county. Pickford is a wooded township, Stalwart being about 35 miles from Sault Ste. Marie, and some 20 miles from the nearest physician.

Measures of Restriction—Results.

No person had yet been reported to this office as health officer for the township of Pickford for the year 1886. The following letter was sent to J. W. Pickford, supervisor of that township:

"A case of small-pox has been reported at Stalwart, in your township, and the name and address of the health officer not having been returned to this office according to law, I write to you. I send you a few documents relating to the prevention and restriction of small-pox, and also a few blanks. Your township should have a health officer in communication with this office, and should take measures for preventing the spread of small-pox. All who have been exposed to the disease should immediately be requested to be vaccinated. I can send more documents if you need them."

Also 20 documents were immediately sent to Mr. Philip Waybrant, of Stalwart, who was recommended by Dr. Bacon, the attending physician, as a man who would distribute them in a satisfactory manner. A letter accompanied the documents stating that more documents could be furnished if necessary, and emphasizing the importance of immediately vaccinating all exposed to the disease. Documents were also sent to Dr. W. B. House, health officer of the adjoining township of Detour.

Patrick Lawless was appointed health officer of Pickford township, and on

June 24 reported 4 more cases in the same family. On June 29 he reported still another case, and one death in the same family. He further states that the sick were strictly quarantined, the neighboring school was closed, and the people in the vicinity were promptly vaccinated. Two nurses (male and female) were procured and furnished with all needed supplies for the afflicted family by a system which, it was thought, would prevent the spread of the disease. The burials were performed by the nurses.

In his final report the health officer states that "fumes of sulphur were used as a disinfectant," and that "there was no appearance of contagium outside of the premises" where the disease first appeared.

Source of Contagium.

The first person sick with small-pox was Alexander Montgomery, who came from Harrison, Canada, taking the C. P. R. steamer Athabasca at Owen Sound, and arriving at Sault Ste. Marie about May 20, and going thence to his sister's, at Stalwart, where on June 1 he was stricken with the disease. Montgomery stated that he was not aware of having been exposed to small-pox; but it was reported to this office on June 18, 1886, that the deputy collector of customs at Sault Ste. Marie had received information from private source that "the C. P. R. steamer Athabasca dropped two of her men off at Owen Sound suffering with small-pox. Also the steamer Pacific, a Canadian local boat trading between Collingwood and Sault Ste. Marie, dropped two of her men afflicted with the same disease." This report is sustained by the facts as given by P. H. Bryce, M. D., Secretary of the Provincial Board of Health in his "Report on the Quarantine System of the St. Lawrence." After a somewhat extensive examination of this system, and a pointed statement of its inefficiency, Dr. Bryce says:

"From what has already been said regarding the non-issue of the promised regulations for 1886, and from the statement of the quarantine officer of Grosse Isle regarding his limited powers as given in answer to my question, it will be seen that the Board of Montreal, the authorities of Ontario, Manitoba, and the States of Michigan, Illinois, etc., must, with a due regard for the trust committed to them, condemn the culpable neglect of the Dominion Government in failing to protect the health interests of so large a population of the people of the Dominion and the United States.

"In reply to a question, Dr. Montizambert, although according to a statement in a Quebec paper there had been during the season 161 arrivals from sea at that port, has informed me that only one vessel, in addition to two already mentioned, has stopped at Grosse Isle during the present season up to the date of June 24th.

"Dr. Laberge has referred to possible dangers, but I propose now to show that these have been realized not only in previous years, but even in the past two months of the present year.

"On June 12, (1886,) I was communicated with by Mr. Henry Beatty, manager of traffic on the Lake Superior line of the C. P. R., to the effect that two of the crew of the steamer 'Athabasca' had been taken sick with small-pox during the first week of June, that one had died at Wiarton, and that the other was then sick at Leith, near Owen Sound. He has obtained the facts of the case, and from them the only explanation at present possible of the manner in which these men contracted the disease is the following: Mr. Beattie says: 'On inquiry I find that on the 19th May some Russian emigrants went up on the 'Athabasca,' and on the 26th, five foreign emigrants, *via* Newark, also went up on the same steamer.'

"Imagining that some such persons, either infected or carrying infection in their baggage or clothing, had communicated the disease, I have taken the trouble to inquire regarding the previous route traveled by those of 19th of May, and find that of Russian emigrants, passengers on the S. S. Sarnia, one child with small-pox, and one man of another family, also suffering with small-pox, were landed at Grosse Isle. Their families were landed, and the sick man's child, which had been shut up in the same cabin with him, and vaccinated by the ship's physician only the night before landing at Grosse Isle, also took the disease on the island. The two children died.

"These Russians took passage on the 'Athabasca' May 19th, or six days after the ship put in to Grosse Isle. The period at which the men of the 'Athabasca' took small-pox corresponds exactly with the fourteen days commonly necessary for the incubation of small-pox.

"The cases of small-pox occurring in Chippewa county, Mich., at about the same time as the men on the 'Athabasca' took sick, have been further directly traced to a young man who went from Harrison, Ontario, to Sault Ste. Marie, on the 'Athabasca,' on May 19.

"I am further officially informed that the case of small-pox at Woodlands, Manitoba, was that of a woman who arrived at Winnipeg from Britain at a period corresponding very nearly, if not exactly, with the 19th of May. * * * * Without discussing the possibilities which we all know may arise from one case of infectious disease, we can only ask, putting the question to the quarantine authorities, can they find any excuse for their continued non-action sufficient to remove from them the terrible responsibility of allowing such infected persons, during a period of six days between Quebec and Owen Sound, the splendid vessels of the C. P. R. for two more days on the upper lakes, and the C. P. R. trains and stations for a period of at least two days more betwen Port Arthur and their destination in Manitoba?"

QUARANTINE OF THE ST. LAWRENCE.

As the contagium in half of the outbreaks (possibly, with one * exception, all the cases) of small-pox in Michigan during 1886 may be traced to the St. Lawrence as its probable source, it is deemed proper that some remarks be here made regarding the system of inspection and quarantine of the St. Lawrence. Complaints have been made from time to time of the inefficiency of this system. But at the International Conference of State Boards of health at Washington, Dec., 1885, Dr. F. Montizambert reported that he was authorized by the Minister of Agriculture to state:

"1st. That an order in council has been passed requesting British consuls and United States authorities to notify the department of the presence of infectious disease at the various ports at which they reside.

"2d. That the regulations are to be enforced with regard to the medical inspection of all inward bound vessels at Grosse Isle, except mail steamers, which are inspected at Rimouski.

"3d. It is proposed to urge steamship companies to provide suitable hospitals on deck, if possible, and ventilated from above and not by the doors.

"4th. It is intended to cause the evidence of ship masters and surgeons to be given under oath, the quarantine officer being authorized to administer such oath.

"5th. That the order had been forwarded to the owners of all ship companies having vessels calling at St. Lawrence or other Canadian ports, requiring them to have compulsory vaccination carried out by their ship surgeons or other persons, of every unprotected passenger, and of their ships' crews and deck-hands."

Now, if these promises had been carried out, in connection with the existing regulations, there would have been little or no danger of the introduction of small-pox from this source. But from Dr. Bryce's report to the Provincial Board of Health, it is evident that these rules were never issued; that vaccination was not enforced by the quarantine authorities or by ship surgeons; that the evidence given by ship masters and surgeons was not given under oath, and that up to June 24, out of 161 vessels arriving from sea at the port of Quebec, only three stopped at Grosse Isle. As a result of this lax quarantine small-pox was scattered at many places west of Grosse Isle where health authorities were led to believe that they were properly protected by the increased efficiency of the quarantine system of the St. Lawrence. However, it is but fair to Dr. Montizambert and the Canadian health authorities to say that at the meeting of the American Public Health Association at Toronto in October, 1886, Dr. Montizambert, as quarantine delegate, in the course of his remarks gave the following explanation regarding this matter:

"It (vaccinal protection for cabin passengers) is now required in Canada, but not under ordinary circumstances at New York, Boston or Portland, where it is only enforced if small-pox has occurred on the voyage. * * * But it is obvious that, as Canada is not an island or surrounded by maritime quarantines, she cannot stand alone in this matter. If she orders vaccination, and Portland, Boston

* It is possible that the St. Lawrence is the source of the Detroit outbreak, and, if so, there was only the one case (at Grand Rapids) not derived from the St. Lawrence.

and New York will not, the effect will simply be to divert Canadian first-class ocean passengers into Canada *via* one of these ports, instead of *via* the St. Lawrence. They will still come unprotected into our country, the only difference being that they will enter Canada a few hours later, so that our steamship lines would be injured without any gain to the public health."

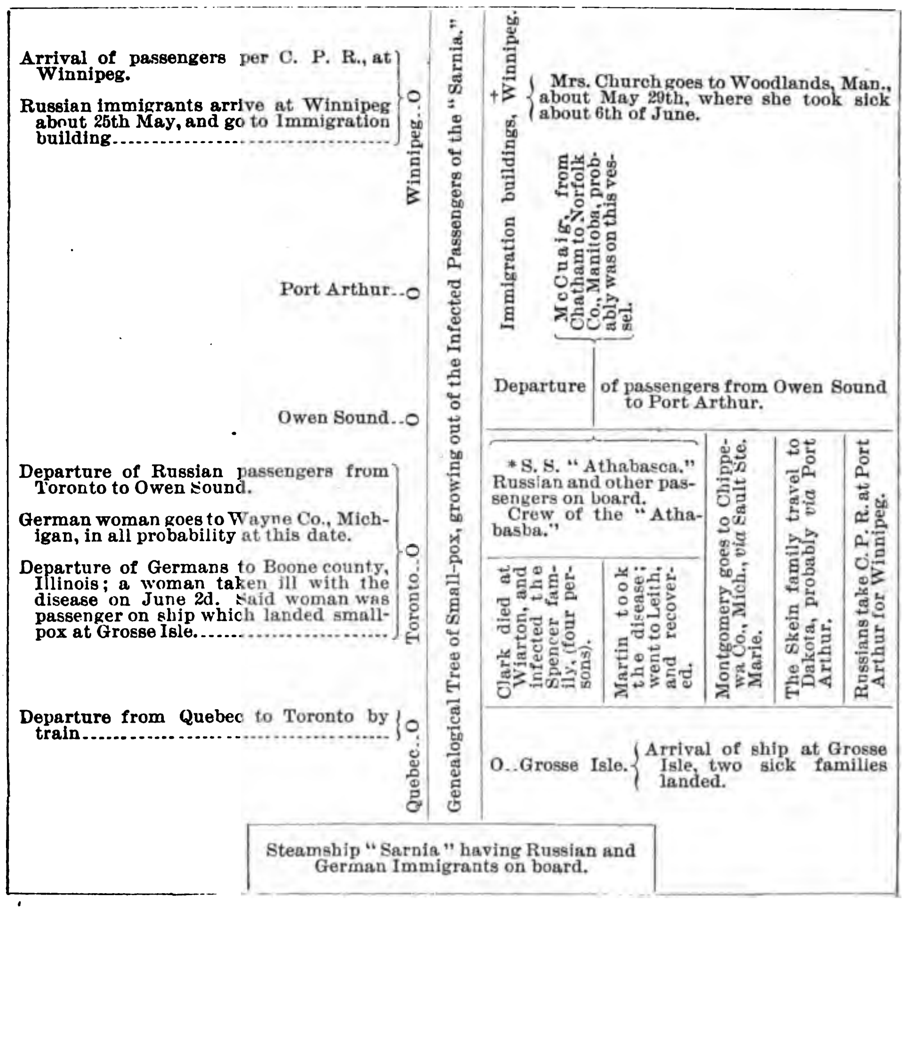
This indicates the importance of uniform action in this direction at both United States and Canadian ports.

The following diagram called a "Genealogical tree of small-pox growing out of the infected passengers of the steamship Sarnia," copied from the fifth annual report of the Provincial Board of Health of Ontario for 1886, is an interesting ocular representation of how the disease spread from infection in a single vessel.

GENEALOGICAL TREE OF SMALL-POX GROWING OUT OF THE INFECTED PASSENGERS OF THE STEAMSHIP "SARNIA."

Summing up these various outbreaks, which may have owed their origin to certain Russian immigrants, some of whose fellow countrymen and fellow-passengers have been left sick at Grosse Isle, and which, until further rebutting evidence is produced, we shall assume did owe their origin to said infective cause we have:

(Copied from the Fifth Annual Report of the Provincial Board of Health of Ontario, being for the year 1886.)



TYPHOID FEVER IN MICHIGAN DURING THE YEAR ENDING DECEMBER 31, 1886.

At the beginning of 1886, for the purpose of aiding the local boards of health, and all others interested, in the prevention of typhoid fever in Michigan, a six-page pamphlet was prepared and printed for distribution by the Secretary of the State Board of Health. A copy of this pamphlet is printed on pages 148–153 of this report. A circular letter to physicians relative to reporting communicable diseases was issued in April, 1886, in which was a paragraph relative to typhoid fever as follows:

This Board regards *Typhoid Fever* as a communicable disease, and one coming under the section quoted below [the law requiring the reporting of all diseases dangerous to the public health]. Cases of this disease should be reported to the health officer, the same as cases of small-pox, scarlet fever, or diphtheria.

During the year 1886 an effort has been made to obtain a complete history of each outbreak of typhoid fever of which any information has reached the office of the State Board of Health. Upon receipt of such information, from any source, a letter was sent to the health officer of the township, village, or city in which the outbreak was reported. The letter urged prompt action to restrict the disease, and asked for weekly reports of progress. Copies of the pamphlet referred to above were sent to the health officer for distribution to the family and neighbors of the family sick. These pamphlets gave concise directions how to prevent and restrict typhoid fever.

In the office of the State Board a record of all correspondence concerning such outbreaks is kept for convenient and immediate reference in efforts to complete the history. It is often found necessary to make inquiry regarding the progress, termination, and results of the outbreak. To facilitate these inquiries a postal card was prepared, of which the following is a copy and which explains itself:

OFFICE OF THE SECRETARY OF THE STATE BOARD OF HEALTH,
Lansing, Michigan, ——— —, 188–.

Dear Sir: On ——— —, 188–, I wrote to you in regard to an outbreak of ——— in your jurisdiction, sending you blanks for reporting to this office.

I have received from you no weekly report on blank M in regard to it since ———. If the outbreak is over will you have the kindness to make a final report on blank K?

Very respectfully,

——— ———,
Secretary.

Sixty final reports, more or less complete, of outbreaks in different parts of the State, have been received and the information compiled. Information that has come to hand through the annual reports of health officers and clerks, and from letters, has also been compiled. It is believed, however, that the facts concerning a large number of cases of sickness and deaths from typhoid fever in this State have not reached this office.

There were reported during the year ending Dec. 31, 1886, 290 outbreaks of typhoid fever in 282 localities, with 1,194 cases and 282 deaths, or 4.15 cases and .75 deaths per outbreak. There are not counted in this statement outbreaks reported on weekly postal cards and not otherwise reported. These cards do not always give the number of cases and deaths, but only the relative order of prevalence. For the year 1886, the reports concerning typhoid fever

are more complete, as a whole, than for any previous year. Counting those reports only which stated the number of cases and deaths, there were reported during the year 1886, 479 more cases, 23 more deaths, in 82 more localities, than were reported in the same manner in 1885. The per cent of deaths to cases in 1886, according to the reports, was 18; in 1885 this per cent was 23. Probably these per cents are large because mild cases were not reported.

TIME OF YEAR WHEN TYPHOID FEVER WAS MOST PREVALENT.

Of the 253 outbreaks where the time of year was stated, the greatest number, 65, began during the month of September, 39 began during the month of August, 29 in October, 28 in November, and 27 in July. In these five months three-fourths of all the outbreaks began. Fourteen began in January, 12 in December, 11 in June, 10 in February, 9 in March, 5 in May, and 4 in April. In a large number of these outbreaks only a single case occurred.

SOURCE OF CONTAGIUM OF TYPHOID FEVER.

The reports show that, as a rule, the health officers do not yet succeed in tracing outbreaks of typhoid fever to their source.

In 102 of the reports of outbreaks of typhoid fever nothing is said concerning the source of contagium. Of the remainder 50 reported the source of contagium as "unknown;" 3 said "impure drinking water;" 2 said "low water in wells;" 2 others report "contagion;" 2 say "from exposure." Other health officers report as follows: "Sleeping with filthy person," "overwork and bad water," "low and bad water in wells," "bad water-supply," "surface water," "drinking swamp water," "contaminated well water," "defective sewerage," "defective drainage," "filthy yard and water," "from cistern water," "infection in Deer Lake camp," "privy and barn near well," "contracted in lumber camp," "by taking care of a sister who died with the disease," "contracted from a patient in another town," "decomposing animal matter in cellar—the house had been used for meat market," "exposure by contact near Sheridan," "believed to have been caused by dead cow being buried near water supply, and soakings of filthy underground stables near same water," "dry weather," "exposure to wet and cold," "first case came from Morley, Mich.; others by contagion," "from Toulouse, Alabama," "undue exposure, uncleanliness," "at South Riley," "can't trace it at all," "brought from Harbor Springs," "foul cellar and filth about premises," "hot and dry weather," "dirty water from shallow well near barn-yard," "Indiana," "by being on boat loaded with sprouting and rotten potatoes," "stagnant water in cellar," "close proximity to low, marshy land," "there was no cause visible," "I think was from bad water, it being very dry and then very wet, the water standing on the surface," "was caused by exposure and over eating," "sporadic; no cause of contagion is known," "I think was foul privy vaults," "the unsanitary condition of a tenement," "this girl (first case) was brought here from Harbor Springs sick," "three patients used dirty-looking water from a shallow well near a dirty barn-yard; others unknown," "supposed to be from impure water drank in another jurisdiction (Liberty, Jackson county)," "patient was sailing, and vessel was unloading at Chicago, Alpena, and Buffalo; says the water was very bad at Buffalo and Chicago," "well about eight feet deep, and for a month previous to sickness contained only about a foot of dirty water," "came here from Port Huron," "first case brought from Oxford, Oakland county," "one came from Morley, and came

down with typhoid fever in a few days," "the man evidently contracted the disease while away visiting, being at Romeo, Pontiac, Holly, and Flint," "unknown, as the patient was a mission minister preaching in several places. He was about half the time at Manistee," "young man was working in Buckley & Douglass' logging camp, and came home sick with typhoid fever."

Concerning an outbreak at Ishpeming the health officer writes: "The source of contagion is not known—several cases taken sick while crossing the ocean, several contracted the disease under-ground in the mines." Other health officers report as follows: "No satisfactory evidence obtainable," "the three families used water from the same well," "the patient was visiting in the village of Sheridan during the summer vacation, where there were similar cases. She came home only *a few* days before she was taken sick," "this case was moved to this place on the seventh day after she was taken," "first case by impure water, and nursing a child who was sick and died from an abscess; other cases from overwork and exposure," "drinking water contaminated with refuse from fish house," "imported from Big Rapids," "came from Jackson not feeling well," "it was a sporadic case, and no source of contagion is known," "I know of no cause except excessive heat and changeable weather," "the patient lived in a poor up-stairs tenement adjacent to an obstructed water-course and saw mill, and fifteen years' accumulation of saw-dust in connection with a cess-pool of filthy water. * * * * Was not of strictly temperate habits." The health officer at Jackson writes concerning an outbreak reported by him in November: "Two were in a family in which one died from this disease last year. The other was in the immediate vicinity of Blackman, where so many cases occurred last year, and so far as I could learn but slight precautionary measures were taken to prevent its spread." Another health officer reports: "The only source suspected is sleeping with a person that was very filthy, and as expressed to me 'rotten,' I suspect from venereal disease." Another health officer writes: "An old cistern about six or eight feet from the well gave way and the contents drained into the well, which I think was the source of contagion. Many others who got water at this well were affected with an obstinate diarrhea."

G. F. Knowles, M. D., health officer of Onekama township, writes concerning the source of contagium in an outbreak in his jurisdiction in October:

"As near as I can judge, from scanty water-supply, making the remaining water, to which cows had access, stagnant and impure, thus injuring the quality of the milk; also [from] poisonous exhalations from stagnant pools." * * * *

In a report sent one month later the same health officer says:

"During the present summer the weather was extremely dry, hence the water supply, especially for running stock, must have become contaminated; also owing to the low land along the the lake shore numerous stagnant pools existed. The disease seemed to locate about such places."

Mason W. Gray, M. D., health officer of Pontiac, writes in regard to an outbreak in the township of Pontiac:

"The origin of the case is in doubt, but I think the father must have received the contagium in some way away from home, as he was managing a threshing machine, and necessarily drank water and milk from many different sources, though none so far as I can learn where there were any cases of fever. The premises seem free from suspicion."

In regard to an outbreak at Troy, in Oakland county, the same health officer writes:

"The two cases were in the family of R—— D——. During the summer one of the daughters visited a relative of the family in the vicinity of Davisburg where several were sick with fever.

After returning home she was sick for two or three weeks, but did not have a doctor. About the time this case recovered another sister sixteen years old was taken sick, and having no medical attendance for four weeks, a typical case of typhoid fever developed. In the meantime a sister nine years old was taken sick."

Another health officer writes concerning the source of contagion: "Patient was cook on a sailing vessel plying between Muskegon and Chicago, and probably contracted the disease on board ship. Purser states that others on the same vessel are affected."

James Gibbs, health officer of Mears, Oceana county, writes concerning an outbreak in his jurisdiction:

"It is supposed to be caused by the use of water affected by the wash of a filthy barn and yard, in the first cases; after that the cause is unknown. We had very dry weather the fore part of the summer, the latter part very wet."

Another health officer writes: "I can not be positive, but think the well must have been polluted. The privy and barn-yard were near, and the ground very flat and heavy clay. No other cause has been discovered."

In the autumn of 1886, an outbreak of typhoid fever occurred at the Agricultural College, three miles east of Lansing. The first case was that of a son of Henry G. Reynolds, secretary of the college. The well from which the water was obtained for the use of the family was afterwards examined by Dr. Kedzie, and the water found to be badly contaminated. At about the same time several other cases occurred at the college, two of which were taken to their homes and there died. No definite account has been received from the authorities of the college. From a physician who attended a part of the cases the names of eleven students sick with the disease were learned. Another physician gave his opinion that only two or three students had genuine typhoid fever, the remainder having some sort of malarial fever. The supposed source of contagium was the water at the well, near the greenhouse, from which many of the students obtained their drinking water. It was found that a common drain-tile which had been laid to drain the greenhouse cellar, and which passed within ten or twelve feet of the well, had been used to carry off kitchen and other slops, and that the water of the well had become very impure and unfit for use. The water was at once condemned and the well afterward ordered filled up.

PERIOD OF INCUBATION OF TYPHOID FEVER.

Under this head two health officers reported the period of incubation as "unknown;" two others said "nothing positive;" two others say "unable to tell;" two others "nothing can be learned;" others say "do not know," "none observed," "could not ascertain the period;" one said "in two cases ten and fourteen days;" another "in one case in which two occurred in the same house the period must have been at least twenty-eight days in the last case;" another health officer says "one case occurred in about two weeks after the cistern gave way (the breaking of a foul cistern near the well was the supposed cause of the outbreak), and the second case about a week after that." Another health officer writes: "The first case was February 13; the last three February 22;" another, "in the two outbreaks (where there were two sick in the same house) one case followed the first in about a week, and the other in about five weeks;" another says "in each family where more than one was taken the period of incubation was about one week."

The period of incubation is doubtless difficult to determine, from the fact

that it is impossible, in most instances, to discover just when the specific poison entered the system. Some health officers apparently confound the period of incubation (the time from the actual exposure to the germs of the disease until sickness begins), with the first stages of the disease. One health officer under this head says: "The cases were complaining from four to six weeks before becoming prostrated."

It is hoped that the health officers will soon be able to trace the sources of this disease with greater certainty; and a knowledge of the usual period of incubation would be very useful in such investigations. From what is known of the disease, the average period of incubation is probably about eleven days.

MEASURES TAKEN TO RESTRICT TYPHOID FEVER.

Under this head several health officers reported simply "disinfection," "disinfection of stools," "disinfection of clothing and feces," "disinfection and burial of discharges," "privy-vaults have been disinfected," "precautionary measures have been taken," "case isolated and disinfection of discharges," "cleaning the house and the premises," "quarantining family where patient is," etc. Such replies would be more valuable if the information they contain was put in more definite form by telling what disinfectants were used, and in what quantity, and what precautionary measures were taken.

Other health officers reported as follows: "The house owner was directed to disinfect with burning sulphur the chamber occupied by the patient;" "all rooms in the house were disinfected with bromo chloralum;" "isolation of patient, barring out unsanitary wells, disinfecting all emanations from sick patients, also privy-vaults, cellars, etc.;" "notice put up; no one except those who took care of the patient allowed to go in the room; everything thoroughly disinfected;" "no one allowed to visit the patient except physicians and nurses; discharges thoroughly disinfected;" "a thorough cleaning and disinfecting of all out-houses, privies, etc.; also burying all patient's excretions;" "being in the country I did not order isolation;" "isolation, public notice, boiling of water, disinfection of all vessels used in sick room, and foeces disposed of as ordered by State Board;" "rooms disinfected with sulphur; discharges disinfected with chloride of lime; well cleaned; discharges carried away 1,000 feet;" "discharges passed into saturated solution of copperas, and buried after nature of disease was known; five pounds of copperas used in privy-vault;" "disinfecting and burning all discharges from patient; perfect cleanliness of patient and nurse, and free use of disinfectants;" "isolation as far as practicable; all discharges were passed into a vessel containing a strong solution of carbolic acid, and promptly buried 100 yards or more from house and well; disinfection of rooms and clothing;" "discharges passed into saturated solution of copperas; five pounds of copperas used in privy vault;" "careful isolation, with care in not allowing articles used about the patient to be used; they were either destroyed or thoroughly cleaned;" "those laid down by State Board * * * * followed as closely as possible;" "kept the would-be visitors away from the house;" "disinfection of privy-vault, into which excreta was thrown; I do not know that any preventive measures were taken during life;" "isolation; discharges passed into sulph. iron; isolation as much as possible; disinfection of stools, removal of filth;" "rooms disinfected with sulphate of iron and carbolic acid; discharges disinfected with chloride of lime and sulphate of iron and buried;"

"as laid down in circular; disinfectants for rooms, copperas; for clothing, zinc and salt; for contents of privy-vault, copperas and hydrated lime; discharges passed in copperas;" "thorough disinfection of discharges, and cleanliness of patient and surroundings;" "by keeping all out except doctors and nurses, disinfecting all rooms in house; contents of privy-vault disinfected with lime;" "where the first case occurred they sold milk; board directed that the sale of milk be stopped; * * * * in other cases restriction by board was unnecessary, as precautionary measures were followed by householders;" "parties isolated; carbolic acid used in room; discharges burned;" "house was placarded with typhoid fever sign; strict orders given to attendants to admit no persons other than those essential; egress to uninfected portions of house restricted as fully as possible;" "usually good hygienic measures, using only perfect cleanliness as a disinfectant."

Dr. G. E. Corbin, health officer of St. Johns, writes:

"I distributed the typhoid fever circulars to family and neighbors, and took pains to mark passages most necessary for different parties to observe, and spent time advising all whom I met at the premises, or near neighbors who were interested enough to listen."

Another health officer writes:

"The physician ordered great care by burying discharges, disinfection with chloride of lime. * * * I called on the patient the same day, left a pamphlet on typhoid fever, and ordered them to follow its directions, which they have done as far as I can learn."

Another writes: "I stopped all getting water at this well, and had the cistern and well thoroughly cleaned, and in the house where the fever was I used strict measures to restrict the disease by using disinfectants, cleanliness, isolation, etc." In regard to another outbreak the health officer states:—"As large and well ventilated a room as possible was taken for a sick room, and all avenues to other parts of the house kept closed, and plenty of calcium chloride." Another reports "careful disinfection and burial of all discharges, general sick room sanitation, disinfection of bed clothing in the hot zinc solution. In general the instructions of the State Board of Health have been carried out."

SUCCESS OF EFFORTS FOR RESTRICTION OF TYPHOID FEVER.

Concerning the success of restrictive measures eight health officers simply said "good," one said "perfect," six said "successful," two said "complete." Other health officers replied as follows: "Satisfactory, only one case occurring in each family;" "no spread outside the family;" "no other case has occurred or is liable to occur so far as indicated;" "in two instances I have had two cases in the same family, all others but one in the family;" "all that could be desired;" "no spread outside the family;" "good, there being no further outbreak;" "no other cases have occurred;" "the number of cases has been materially lessened;" "grand success, as there were twelve inmates in the house and no signs or symptoms followed;" "no more cases occurred;" "no case followed;" "has not spread;" "no other family has taken the disease;" "none but the family where the fever broke out were taken;" "no second case has appeared;" "I had no house in which more than one was sick in my practice."

G. E. Corbin, health officer of St. Johns, writes: "Just nothing at all. The disease made its appearance at all sorts of unexpected times and places, with no traceable connection to exposure or other known cause." Another

health officer says: "Saw no evidence that the disease was communicated from one person to another." Another, "to all appearance of but little use, as it would break out in a different part of the township;" another says "not great."

The evidence from other sources is conclusive that typhoid fever can be and has been greatly lessened by improved water supply and better disposal of excreta; and there is strong ground for hope that as health officers and the people generally become accustomed to searching out the causes, and removing them, their success in preventing typhoid fever will be well worthy of record.

MEASLES IN MICHIGAN DURING THE YEAR ENDING DECEMBER 31, 1886.

For the year ending Dec. 31, 1886, there were reported in Michigan by all the reports received at the office of the State Board of Health (excepting the weekly report cards) 2,192 cases of measles in 91 localities, an average of about 24 cases to the locality, and there were 29 deaths, an average of one death to 76 cases. During the year 1885 there were reported to this office only 673 cases and 23 deaths in 70 localities, an average of 10 cases to the locality and one death to every 37 cases. It will thus be seen that there were reported over three times as many cases and six more deaths in 20 more localities in 1886 than in 1885. However in 1884 the amount of measles reported was about the same as in 1886, there being reported in 1884, 2,173 cases and 33 deaths in 131 localities.

It is well understood, however, that it has not yet become the uniform custom to report cases of measles.

SOURCE OF CONTAGIUM.

Of the 91 reporters (health officers and clerks) reporting outbreaks of measles, 49 did not mention source of contagium; 20 stated that the source was not known to them; 16 reported the disease as coming from places beyond the limits of their respective jurisdictions; 2 stated that it was "epidemic;" 2 that it was from "exposure," and 2 that it was from "contagium."

TIME OF YEAR WHEN MOST OUTBREAKS OF MEASLES BEGAN.

Of the 78 outbreaks of measles where the date is reported, 21 began during April and May, and 22 began during November and December.

MEASURES OF RESTRICTION.

In the 19 outbreaks something in the way of restriction was reported; such as,—"the case is isolated," "precautionary measures have been taken," "quarantined," "school closed," "house placarded," etc.

Under date of Nov. 28, 1886, S. W. Merritt, M. D., health officer of Fort Gratiot, wrote as follows:

"We have in this village a great number of children sick with measles. I have not caused placards to be put up, as I think it quite uncalled for and not mentioned. I have taken particular care to prevent the spread. What else can I do? I think the best time for them to have it is while at home."

The following reply was sent:

"Measles is a dangerous communicable disease. The law says that the health officer shall give public notice of such infected places by placard and otherwise, if necessary. I send you a copy of the law."

WHOOPING-COUGH IN MICHIGAN DURING THE YEAR ENDING DECEMBER 31, 1886.

There were reported in Michigan during the year ending Dec. 31, 1886, by all the reports received at the office of the State Board of Health, except the weekly report cards, 2,642 cases of whooping-cough and 62 deaths in 157 localities, an average of about 17 cases per locality, and the deaths were 2.4 per cent of the cases.

The mortality from whooping-cough is so much less than that of diphtheria and scarlet fever, and such are the difficulties of restriction, that it has not engaged the attention of the State Board to the same extent. This will, in part, account for the incompleteness of the reports concerning this disease compared with scarlet fever and diphtheria. It is probable that the number of cases and deaths stated above is greatly below the number which actually occurred. The annual average number of cases and deaths reported to the Secretary of State for the fourteen years 1869–1882 was 150,* and there is reason to believe that even this number is not more than one-half the number which really did occur.

SOURCE OF CONTAGIUM OF WHOOPING-COUGH.

Forty-five reporters (health officers and clerks) reported that the source of contagium was unknown; seven stated that the disease was contracted at school; twenty-one stated that it had been brought from some other locality (in one instance from Indiana; in another from Dakota); fifteen replied "contagium" or "exposure." Other replies were received as follows: "Climatical," "various causes," and "natural causes."

TIME OF YEAR WHEN WHOOPING-COUGH WAS REPORTED MOST PREVALENT.

Twenty-six outbreaks were reported to have commenced during the winter months, twenty-one during the spring, thirty-four during the summer, and forty-three during the fall. But two outbreaks were reported to have commenced during the month of February, while nineteen were reported as having commenced during November.

MEASURES OF RESTRICTION.

In a few outbreaks the premises were reported as having been placarded, isolated, etc., but it is evident that too little effort is made in this direction. Many lives might be saved, and much sickness prevented by generally enforcing proper restrictive measures.

GLANDERS.

This most loathsome and fatal disease in man is uniformly traced to glan-

*Sixteenth Registration Report, Michigan, for 1882, p. 269.

dered animals, generally to the horse,* and on this account outbreaks of glanders among animals is a "disease dangerous to the public health." For an outline of this disease and the measures for restricting it, see Report of the Michigan State Board of Health for the year 1879, pages 301-334.

GLANDERS IN MICHIGAN, YEAR ENDING DECEMBER 31, 1886.

During the year ending Dec. 31, 1886, glanders was reported in Michigan in nine localities; and suspected glanders was reported in seven other localities. The details are given in connection with each locality.

GLANDERS IN ALCONA TOWNSHIP, ALCONA COUNTY.

On Feb. 17, 1886, the following letter was received at this office from Dr. Mulholland, health officer of Alcona township, Alcona county:

"There is a disease prevailing among the horses of this township which has all the symptoms of glanders. The township board of health has ordered one of them killed, and there are three more that have all the symptoms of glanders according to the description sent out by the State Board of Health for the year 1879. Our board respectfully requests that the State Board of Health send one of your board or an agent to investigate the matter, as we have no experts in the township. The township board paid Mr. Grulo for two horses which he killed in the latter part of Dec., 1885, and the one killed by the order of the board was on Feb. 8. The horse was in a horrible state. If you cannot send a member of your board or an agent, please send instructions in regard to the matter."

In reply the following was sent from this office:

"All horses suspected of having glanders should be thoroughly isolated until all danger is past. It would be well for your local board to adopt, publish, and enforce regulations against the spread of glanders. In the pamphlet on glanders which you mention, there is a set of such regulations recommended by this board.

"This board has not enough money at its command to permit of its sending agents about the State to investigate suspected cases of glanders. We are in the habit of recommending local boards of health, whenever they are in doubt concerning cases of glanders, to isolate the suspected animals and then send for a competent veterinarian to decide the question. Dr. E. A. A. Grange, professor of Veterinary Science at the Agricultural College, near Lansing, Mich., is very reliable, and his decision could be depended upon. He charges $10 per day and expenses. Your board can well afford the expense rather than endanger the lives of your citizens by allowing the glandered horses to live; for glanders is a disease exceedingly dangerous to man as well as to animals. Allow me to suggest that glandered horses are not worth anything, and hence should not be paid for by the board of health."

On March 9, 1886, another letter was received from Dr. Mulholland, as follows:

"Up to date three horses having a disease called glanders have been killed, and there are several horses still isolated. Enclosed find regulations adopted by our board, and recommended by the State Board of Health."

Regulations Adopted by the Board of Health of Alcona Township, Alcona County, Michigan.

Glanders in horses or other animals is a disease dangerous to the public health, because it is often communicated to man, and in a majority of cases proves fatal. As a means of preventing its communication to men, the board of health of the township of Alcona, county of Alcona, State of Michigan, hereby, on this 26th day of February, A. D. 1886, adopts the following regulations for the restriction and prevention of glanders within its jurisdiction:—

1. The owner or owners of a horse or other animal, and the person or persons having the care of a horse or other animal, within this township, knowing or having reason to believe the same to have the disease called glanders or farcy, shall keep such horse or other animal separate and apart from all other animals.

---

* Ziemsson's Cyclopedia, Vol. III, p. 349; also Durham, Quain's Medical Dictionary.

A hard, knotted swelling on the inner side of the under jaw blade, together with a running from the nose of a horse, ass, or mule, affords "reason to believe" (until the question is otherwise decided by a competent veterinarian) that the animal has the disease called glanders; and this belief is strengthened if the animal has ulcers on the membrane lining the nose. Boils or buboes (on a horse, ass, or mule) which soon open and form ulcers with inflamed or corroded edges, together with cord-like swellings near the ulcers, or knotted swellings of the adjacent lymphatic glands, afford "reasons to believe" that the animal has the form of glanders called farcy.

2. No owner of a horse or other animal, and no person having the care of a horse or other animal, knowing or having reason to believe the same to have the disease called glanders or farcy, shall lead, or drive such animal, or permit it to go, in or over any public common, street, road, highway, lane, or alley in this township; or water such horse or other animal, or suffer it to drink, at any public watering trough, pail or spring; or suffer such diseased horse or animal to be kept in any enclosure in or from which it may come into contact with or close proximity to any other animal not infected with such disease.

3. Every owner of a horse or other animal which he knows or has reason to believe has the disease called glanders or farcy, and every person having care of such an animal, within this township, shall at once give notice of the disease and of the location of the diseased animal to the health officer of this township, within twenty-four hours after receiving knowledge of the same.

4. Any veterinary surgeon or person who acts as such, who shall have knowledge of any horse or other animal that has the disease called glanders or farcy, within the jurisdiction of this board, shall report the existence and location of such diseased animal to the health officer of this township within twenty-four hours after receiving knowledge of the same.

5. No person shall knowingly expose, directly or indirectly, a horse or other animal having the disease called glanders or farcy to any other horse or animal not having such disease.

6. Whoever violates the provisions of the foregoing regulations shall be liable to a penalty not exceeding one hundred dollars.*

Dated, February 26, 1886.

JAS. BRAHANEY, J. P.,
D. MULHOLLAND, J. P.,
Members of the Township Board.

Signed,
D. J. McARTHUR, *Clerk.*

OUTBREAK OF GLANDERS IN LIBERTY AND COLUMBIA TOWNSHIPS, JACKSON COUNTY.

On Feb. 5, 1886, a letter was received at this office from G. C. Payne, clerk of Napoleon township, as follows:

"In an adjoining township (Columbia) there are quite a number of horses sick with glanders; one case is just over the town line. I have received notice of the above facts from two veterinary surgeons; but, as none of the cases were in Napoleon township, I have nothing to do with them."

Also a letter, dated Feb. 8, was received from Dr. E. N. Palmer, health officer of Columbia township, stating that he had examined several horses at the farm of Charles Vining, and that there were reported three more at the farm of Mr. Lyster, near by, which were said to be diseased with glanders. He stated that the veterinarians there were divided in opinion, but that he was inclined to regard the disease glanders.

On Feb. 9, the following letter was received from E. R. Hesse, health officer of Liberty township:

"I report to your notice a rather serious and difficult case. * * * * Doctors John Waldren and Henry Haynes, veterinary surgeons of this county, have reported glanders; among the stock of horses, cattle, and sheep of Arthur Brockway, of the township of Liberty, Jackson county, reporting 9 horses, 12 or 14 head of cattle, and 75 or 80 sheep; badly affected. Over 60 sheep have died. Two head of cattle and 4 horses have been requested to be killed. The use of butter and milk has been stopped. Considerable alarm is engendered, and the matter is in your hands to dispose of. Please have it attended to at once."

* In accordance with section 1694, compiled laws of 1871.

The above was answered as follows:

"I wrote to you yesterday giving you all necessary information for the guidance of your board of health in dealing with that dangerous disease. The State Live Stock Sanitary Commission is especially prohibited, by law, from interesting itself in horses and sheep, and so it will probably do no good to write to the president of the commission in regard to the outbreak of glanders. Glanders properly comes under the province of this Board and the local boards of health, because it is a communicable disease, dangerous to man as well as to lower animals.

"I shall hope to hear that your board acts promptly and effectively in restricting and stamping out the disease. Glanders is also probably present in Columbia township. If you employ an expert to decide the question, he might visit both townships in the one trip, thus saving considerable expense.

"Inasmuch as you mention '12 or 14 herd of cattle' as affected with a dangerous disease, and that 'the use of milk and butter has been stopped,' and that 'considerable alarm is engendered,' I will promptly notify the president of the Live Stock Commission in the hope that the State veterinarian may be ordered to go to your vicinity and aid in stamping out the disease."

Accordingly, on the same day, the following letter was sent from this office:

Hon. H. H. Hinds,
President State Live Stock Sanitary Commission,
Stanton, Montcalm County, Michigan:

Dear Sir: I am in receipt of a letter from E. R. Hesse (dated Feb. 8), health officer of Liberty township, Liberty, Jackson county, Michigan, which states that there are 12 or 14 head of cattle belonging to Arthur Brockway, of the township, that are suspected of having glanders. There cannot be much doubt that glanders is present among his horses and sheep; but your commission have nothing to do with them. I thought I would inform you of the cattle, as the health officer requested, thinking you might deem it of sufficient importance to have the State Veterinarian proceed to Liberty township to investigate. I hope this will be done.

Very respectfully,

Henry B. Baker,
Secretary.

On March 3, 1886, Dr. E. A. A. Grange, State veterinarian, proceeded to Liberty township for the purpose of making an examination of the supposed glandered animals. He reports the results of his investigations substantially as follows:

At Mr. Brockway's farm 9 horses were examined, 3 of which showed symptoms of glanders. On 1 of these 3 post-mortem was held, and evidence of glanders was found. One showed symptoms of farcy (which is another form of the same disease). In the remaining 5 there was no evidence of glanders. Seventeen head of cattle were examined and no symptoms of glanders found. Also a post-mortem was held on a calf; but the disease was not considered glanders. The animal was in a very debilitated condition, had a sore on its nose, and was lame in one hind leg, probably due to exposure to extreme cold, both ears being badly frozen.

From the Brockway farm, in company with Dr. Palmer, health officer of Columbia township, Dr. Grange proceeded to the Vining farm, and examined 6 horses, finding 5 apparently healthy and 1 affected with farcy. The horse which Mr. Vining supposed gave the disease to the others was absent on that day, so the doctor did not see it. On March 4 Dr. Grange wrote Dr. Palmer that these 2 horses should be closely quarantined or destroyed at once.

GLANDERS IN DELAWARE TOWNSHIP, SANILAC COUNTY.

The following letter, dated July 15, 1886, was received from A. Stephens, M. D., health officer of Delaware township:

"On Saturday, the 10th inst., 3 horses belonging to Henry Curts, of this township, were killed and

their carcasses burned, by order of the township board of health. The animals had been examined by a veterinary surgeon and [the disease was] by him pronounced glanders. The examination was made by order of the board of health, and the veterinary surgeon's report made in writing and sworn to. On Tuesday, the 13th inst., at a meeting of the board of hea'th, Mr. Curts stated that he bought a gray mare last fall from one F. Miller of this township. She was believed to be pretty badly affected with heaves, and Curts soon found he could not do his work with her when spring came, so he traded her off to a Mr. Blashel, and Blashel kept her a few weeks and traded her to Mr. Barker, and Mr. Barker to Mr. Bachman, and Mr. Bachman to D. W. Snody, of this village, in whose possession she now is. Mr. Curts claims there was no disease amongst his horses until he got this mare, and during the six or eight months he had her his other horses commenced to discharge at the nose; at first a watery fluid and later on becoming thicker and of very offensive smell. The same veterinary surgeon, by order of the board of health, examined the Snody mare yesterday, and his report is before me, setting forth that he is unable to decide as to the exact nature of the disease in this case; thinks that treatment has modified and obscured the symptoms of the disease to a considerable degree, and asks for further opportunity to investigate the case, and asks that the testimony of the former owners be obtained, and recommends that the mare be kept in the stable and isolated from other horses, etc.

"This mare having been through so many hands since last spring, and in contact with other horses in various parts of the township, I am of opinion that it is highly desirable to determine beyond question the nature of the disease with which she is affected. Snody, of course, claims she is all right with the exception of heaves, and declines to abide by the decision of one veterinary surgeon should it be adverse to him. Now, can the State Board aid us in this matter? What do you advise? What would be the cost of an expert sent by the State Board to examine this case in connection with a local veterinarian? An immediate reply will oblige."

On July 16 the following reply was sent from this office:

* * * "If the two veterinarians should pronounce the horse affected with glanders, your board would be justified in destroying the animal, even if the owner were not willing." * * *

On June 17 a postal card was received from Dr. Stephens, stating as follows:

"Better send the State veterinary surgeon up to investigate the case of which I wrote you pretty fully the other day. A good deal of excitement amongst farmers, and it has become necessary that the case be decided beyond a question, as the animal named has been in the possession of so many within a few months."

In reply the following was immediately sent from this office:

"The State veterinarian *as such* is expressly prohibited from doing anything in regard to horses and sheep. It is unfortunate, I think. In his private capacity, Prof. Grange will probably visit your place, providing your board guarantees to remunerate him. I will notify him of the condition of affairs in your township, so that he may understand it more thoroughly, if you should telegraph to him."

GLANDERS IN SHIAWASSEE TOWNSHIP, SHIAWASSEE COUNTY.

On Sept. 18, 1886, the following letter was sent from this office to J. S. Wheelock, M. D., health officer of Shiawassee township:

"A report reaches this office that on the farm of John Dunlop in the township of Shiawassee (about two and one-half miles south of Owosso) the cattle are afflicted with some disease that seems to be communicable. It seems to be feared that the disease is glanders; but it is the opinion of veterinarians that cattle do not have glanders, so, if the trouble is confined to cattle, I would not greatly fear glanders. If any horses and sheep are affected, however, with anything that appears like glanders, it would be well to have an investigation at once, as that is a disease dangerous to man as well as to animals. If the sickness among the cattle is communicable, you should report it to Hon. H. H. Hinds, president of the State Live Stock Sanitary Commission, Stanton, Montcalm county, Mich., in accordance with the law of 1885, Act No. 182, Sec. 6."

In reply a letter dated Sept. 27 was received from Dr. Wheelock:

"Yours received and investigation made. I find that in July last there was one horse shot on the Dunlop farm, and it was thought to have had glanders. Mr. Dunlop says the Owosso veterinarian

was not certain about the disease. However, he had it killed. He says there has been no disease on the farm since, and there is none now. I also inquired of a near neighbor. He said he had heard of no complaint since the killing of the horse in July last. * * *"

GLANDERS IN ITHACA, GRATIOT COUNTY.

On March 24, 1886, the following was sent from this office to Dr. W. D. Scott, health officer of Ithaca:

"The report reaches this office that there are two cases of glanders in one stable in Ithaca, and that the horses have been ordered killed. As glanders is an exceedingly dangerous disease to man, as well as to horses, this board is interested in the subject. If your board has ordered the destruction of the horses, you probably have investigated the cases. Will you have the kindness to report all facts with which you are familiar that bear upon the cases? I would like to know if the horses are killed."

In reply the following letter, dated March 28, 1886, was received from Dr. Scott:

"There have been two cases of glanders here. The cases were reported to me about two weeks ago. I learned one of the horses was brought here about six months ago and then had a very suspicious discharge from one of the nostrils, but pronounced by one or two 'horse doctors' as not being glanders. About two months ago the horse was mated. The second horse in a very short time was taken with a very profuse discharge from left nostril, which continued with increase till the horses were disposed of. When my attention was called to the cases I summoned two veterinarians of repute to investigate the case. They gave it as their opinion as glanders. But to be positive beyond any question of doubt I had a cat inoculated, also inoculated in the leg of one of the horses. In three or four days the disease was fully manifest in both inoculations. Both horses (and cat too) were killed at once. We had full consent of owner.

"The owner of horses being a poor man, I have recommended to our board a partial reimbursement of $50, and expenses of disposing of them which, without doubt, will be done at the next meeting of the council."

GLANDERS IN RICHLAND TOWNSHIP, KALAMAZOO COUNTY.

On Aug. 12, 1886, the following letter was sent from this office to J. M. Rankin, M. D., health officer of Richland township:

"I learn from the Detroit Evening News of yesterday that a horse having glanders has died in your jurisdiction after giving the disease to other horses. By this mail I send you a pamphlet on glanders, on pages 332 and 333 of which you will find something relative to the duties of local boards of health in cases of glanders; also in a small pamphlet on Work of Health Officers. There is ample authority for isolating all animals suspected of having glanders until all reasonable doubt, if any, is removed." * * *

In reply Dr. Rankin wrote as follows:

"On Aug. 8 the horse was driven from Kalamazoo six miles northeast into Richland township. Late Monday evening I was notified that a diseased horse was in the southwestern part of the town, which should have care. Next morning I saw the horse and pronounced the disease glanders, called the board of health together, and gave my opinion of the case. The board gave orders to have the horse killed and buried. Early Tuesday morning the man employed to kill and bury the horse started out to do the job when he found the horse dead. The horses on one farm were exposed to the disease by the above horse. Nothing more has been done."

On Aug. 17 the following reply was sent from this office:

"I hope that the exposed horses will be isolated until it is known that they have not the disease. I would be glad to know where and how the glandered horse was buried, i. e., how near to wells, etc.

"Please write all you learn of the past history of the horse. It is reported here that W. T. Stewart, V. S., of Kalamazoo, saw a horse there July 15 which he was satisfied had glanders. Came from Battle Creek, was traded in town and taken away."

In reply, the following letter from Dr. Rankin, dated Aug. 20, was received:

"Your inquiry in regard to place of burial of the Richland glandered horse received. It was buried deep in a sandbank, at least a quarter af a mile from any well or house. The horse was owned by some jockeys in Kalamazoo, and they traded it to a citizen of Barry county; he tried to drive it home and got about five miles on the way when he had to abandon it. The horses exposed by the above are being kept closely on the farm."

SUSPECTED GLANDERS IN PITTSFORD TOWNSHIP AND HUDSON.

On April 5 a letter was received from Dr. A. R. Smart, health officer of Hudson, stating in substance that a farmer, some two miles from Hudson, reports what has been pronounced by a Jackson veterinarian a case of glanders. No health officer having at that time been returned for the township of Pittsford, a letter was sent to the supervisor, Mr. A. H. Crane, calling his attention to the reported presence of glanders in his jurisdiction, explaining the dangerous character of that disease and urging that, if there was no doubt about the disease being glanders, the animal be destroyed at once, and with the letter a pamphlet of information on glanders was sent also.

On April 12 the following letter was received from Dr. Smart:

"I thought I said the animal was a horse. It appears the original animal that gave rise to this trouble is now owned in this village, and is driven about our streets, a fact I learned to day. The horse [owned] by Foster (the man in Pittsford) has been killed; but some cattle are infected with what the Jackson veterinarian pronounced glanders. I am told that we have no law that will enable us to dispose of the glandered horse in our village, the law in the matter applying only to cattle."

SUSPECTED GLANDERS IN SIX OTHER PLACES.

Suspected glanders was also reported in the following six places: Maple Rapids, Clinton county; Dorr township, Allegan county; Schoolcraft, Kalamazoo county; Bronson township, Branch county; Ronald township, Ionia county; also at Grand Ledge, there was reported "a horse laboring under what is suspected to be an infectious if not contagious disease," by which glanders was probably meant. In all these outbreaks the local boards were urged to immediately isolate and guard the animals, thoroughly investigate the disease, and, if it proved to be glanders, destroy the animals without delay. Information as to what further was done in these outbreaks has not yet reached this office.

THE CAUSATION OF PNEUMONIA.

BY HENRY B. BAKER, M. D., LANSING, MICH.

At the outset, a few words to three classes of persons, for it may be that indifference to the discussion of this subject may prevail among three classes of thinkers—two holding directly opposite views,—one being the view that it is settled that pneumonia is a specific disease, due to a germ, and only incidentally related to climatic or meteorological conditions; another being the opposite view that it has been settled since the time of Hippocrates that pneumonia is caused by cold, damp air.* The third class strike at the root of all progress in this direction by declaring, as has one of our sanitary writers in this country, that "In so far as the origin and spread of epidemic diseases depend upon atmospheric changes, we can do little or nothing to modify their course, and hence the study of meteorological conditions in connection with the etiology of disease is, to the sanitarian, at present, of no great practical value except to give him the power of prediction to a limited extent."† To the last-mentioned class (which, I presume, includes a large proportion of our fellow-citizens) I would point out the fact that quite a large proportion of our people, including most women, spend the greater part of their time in buildings, protected from out-door conditions, and where the character of the atmosphere may be controlled, as soon as we know just how we ought to modify it to insure freedom from pneumonia. As to the remainder of our people, they all spend at least one-third of their time where the character of the air might probably be controlled. Then as to all who must be most exposed to the out-door air, when we learn the exact source and nature of the danger, much can be done to prevent pneumonia, by controlling the character of the air inhaled while they are in-doors; because it has been found probable, from the evidence in this article, that it is frequently the long-continued exposure which causes the sickness; and very much can be done by diet, etc., toward insuring a condition of immunity by reason of proper condition of the blood; because it is well-known that susceptibility to the disease differs greatly, and this paper may perhaps suggest how insusceptibility may be more generally accomplished. The writer just referred to spoke only of the impossibility of controlling the "epidemic diseases"; but

*"No substantial addition in this respect has been made to the knowledge possessed by Hippocrates, as set forth in his book on airs, waters and places, namely, that cold and damp weather produces diseases of the respiratory organs." John S. Billings, M. D., in Introduction to Buck's Hygiene Vol 1., page 34.

† John S. Billings, M. D., Buck's Hygiene, Vol. 1, pages 33–34.

pneumonia has in times past not very infrequently been considered "epidemic"; and that it is not so now more frequently is, I believe, because a better and more general knowledge of its causes, the better conditions of living, and less exposure, tend to prevent its wide-spread and general occurrence. The other two classes of thinkers to which I have referred, answer each other by antagonistic beliefs; and it must, I think, be acknowledged that in order that we shall be convinced that pneumonia is or is not caused by certain agencies and in a certain manner, we must have the subject treated in accordance with the Baconian system,—we must have the evidence of the facts accumulated and studied by the inductive method. The opinion of Hippocrates is good, but not conclusive; and the same may be said of many who have followed Hippocrates. Even since the publication of such comprehensive statistics as those by Buchan and Mitchell, showing the curves for deaths from pneumonia in London for the thirty years 1845–74, Prof. Germain Sée has written: "Besides, the statistics appealed to as demonstrative are absolutely puerile and prove nothing. To one set of statistics it is always easy to oppose another set."* And on the next page he says: "On this point all observers are pretty well agreed in our day in rejecting the old notion that pneumonia is a disease peculiar to the winter. Even Sydenham has said that the maximum of frequency is rather between spring-time and summer and Van Swieten supports the same view. The statistics of Grisolle bearing on 553 cases fully confirm the assertion of Sydenham, and we regard these as fairly representing the observations of each day."† This quotation shows what is meant by Prof. Sée when he speaks of "statistics";—"553 cases" are sufficient, in his opinion, to "fully confirm" an "assertion," but the statistics tabulated by Buchan and Mitchell of over 100,000 deaths in London are "absolutely puerile." It is, therefore, important that we understand the meaning which we give to the term "statistics," and that we have some way of judging of their comparative value, and under what circumstances they are reliable and trustworthy.

This leads me to say that, in my opinion, it is not possible for us to properly estimate the value and bearing of such statistics as the relations of pneumonia to climatic conditions, except we first examine properly-constructed diagrams from such statistics which show the curves representing both sets of phenomena in such contiguity as to be seen at the same time. The average human mind is not otherwise able to grasp and compare so many sets of figures as are requisite in order to compare the two classes of phenomena, especially when (as I think will fully appear further on in this paper) the meteorological conditions in one month must be compared with deaths which occur, or with sickness which is yet present, in a following month. By means of proper diagrams it is possible to compare the statistics of deaths from pneumonia in each country with the meteorological conditions existing at different periods of time; it is possible to compare with the meteorological conditions the statistics of sickness from pneumonia wherever such statistics are recorded, as, for instance, in great armies.

Among statisticians, such a small array of facts as relate to "553 cases" of pneumonia would scarcely be worthy of the dignified title of statistics; because to such statistics, as just quoted from Prof. Sée, "To one set of statistics it is easy to oppose another set." But when to such sets of statistics other sets

---

* P. 73, Diseases of the Lungs. Translated by E. P. Hurd, M. D., N. Y., 1885.
† Page 74.

are continuously added there comes a time when the further addition of such sets has no appreciable influence, because a true mean or average has been reached. It is, therefore, not very difficult to learn whether or not a sufficient number of facts have been collated to make the statistics reliable and trustworthy. By means of proper diagrams it is even possible without waiting to add other "sets of statistics" to judge fairly well whether or not the facts are numerous enough to indicate a true average; because when not sufficiently numerous the curves are not true curves, but irregular lines, for one month or a period of time not in harmony with that for the periods preceding and succeeding. Examples of this may be seen in a few of the diagrams which illustrate this paper, those for single years showing irregularities which are entirely absent from the diagrams on the same subject which show averages for eight years and consequently include about eight times as many facts. The diagram (No. 1) exhibiting the average sickness from pneumonia in Michigan for eight years, and the average temperature in the same years, shows upon its face that a sufficient number of facts respecting both sets of phenomena are included to make true curves, each consistent with itself in the several months, and each curve consistent with the other curve. This is the more remarkable because the observations are of different classes of facts, by different classes of observers,—the temperature being reported by meteorologists, and the sickness by the leading physicians in the State. When curves are as regular as those are in diagrams Nos. 1, 9 and 13, and especially when curves representing facts from two distinct classes of observers run so uniformly together, there is great probability of their truthfulness, as representing average conditions.

The author of this paper has been studying this subject for about sixteen years; but the reason for presenting this paper is the very great quantity of evidence which he has been able to collect and collate, and especially the vast number of accurately-observed and well-attested facts relative to sickness from pneumonia and the meteorological conditions antecedent to and coincident therewith, these facts amounting to thousands per year for several years. It was, I presume, the general lack of such facts which led Dr. Billings to state that no progress had been made since the time of Hippocrates, and that "at present" the study was of no practical value; because he added that "our hope of substantial scientific progress in knowledge of the causes of disease rests mainly on two methods as yet little used, namely, on the registration of disease and on comparative pathology."*

To the "registration of disease" in Michigan, by the direction of the State Board of Health, I am indebted for the greater number of the facts which I here present, and which, I think, prove that in Michigan certain conditions bear causal relations to pneumonia. Although these statistics are, in my opinion, incomparably more valuable for this study than any others which have ever been collected, the best statistics which I have been able to study, relative to sickness and deaths from pneumonia in different States and countries, agree substantially with the results shown by the Michigan statistics. But in order to show *how* pneumonia is caused by these conditions, recourse must be had to studies in pathology, some of which data have for many years been waiting for some one to use them. Chemistry and physiology also supply facts essential to the final generalization which I attempt relative to the causation of pneumonia.

* Buck's Hygiene, Vol. 1, page 34.

Besides the statistics of sickness, I have employed the statistics of deaths in Michigan; because, although we know they are far from complete, yet the nature of some of their defects being known, we can see how far they support the evidence relative to sickness, and perhaps see how some conditions appear to influence the deaths to a greater extent than they do the sickness. The facts relative to the deaths are not so numerous as are those relative to sickness, although for the same series of years, because of the few who die of pneumonia compared with the great number who are sick. The number of deaths reported and used in the several diagrams was, in the eight years, 5,473, distributed in the several years as follows:

Years.	Deaths.	Years.	Deaths.
1877	463	1881	802
1878	462	1882	733
1879	700	1883	736
1880	811	1884	766
Total			5,473

The deaths in London, England, in 30 years (1845–74) to the number of 114,119 are also tabulated, and graphically shown in Diagram 11, p. 273.

The 11,596 deaths in the white troops of the United States Armies during the three years 1862–1864 are also studied in this paper; as also the 49,487 cases of sickness from pneumonia in the same troops. The relations of the deaths to atmospheric temperature are graphically shown in Diagram No. 10, and of the sickness in Diagram No. 9.

The total number "admitted to hospital" of those sick with "Respiratory Disease" (not including phthisis) in the European troops in India during the year 1883, numbering 4,215, and the deaths in this number, only 37,* are also included in this paper.

The total number "admitted to hospital" of those sick with "respiratory disease" in the native troops in India during the year 1883, numbering 6,073, and the deaths in this number, 449,* are also tabulated (Diagram No. 12.)

Analysis of the returns of nearly one thousand (957) cases of pneumonia, reported to the "Collective Investigation" Committee of thc British Medical Association, shows that "59 per cent of the cases occurred in localities seated on *high* ground" and only 41 per cent on *low* ground; that "nearly 55 per cent state the nature of the soil to be *dry*," and only 45 per cent to be *damp;* that 67.3 per cent of the cases were in "exposed," and only 32.7 per cent in "confined" situations.

"The inference from the results is, therefore, that whilst there is not much difference as regards elevation and dampness or dryness of soil, there is a considerable preponderance of pneumonia in exposed places as compared with those in confined situations."†

* The surprisingly small number of deaths from pneumonia reported among the European troops in India, especially when compared with the ordinary death-rate from the same disease among the native troops, is very suggestive of the idea that the European troops had not yet become acclimatized to the very much more favorable climate (with respect to pneumonia) in India compared with their native climate in Europe. The difference is mainly the greater warmth and moisture of the atmosphere in India; and this seems to be excessively favorable to recovery from pneumonia; for although the hospital accommodations and medical treatment of the European troops may be much better than those of the native troops, they are probably not much better than in our own country.

† Vol. II., Collective Investigation Record. British Med. Association, July, 1884, pp. 36–37.

It should be noticed also that what difference there is shown by the facts collected by the committee, as regards elevation and dryness of soil, if we consider that high and dry localities tend toward a dry atmosphere, is in the direction which harmonizes with all the facts which I have been able to collect, and which seem to me to prove that atmospheric dryness is conducive to pneumonia.

This, one of the principal conclusions of this entire article, is stated thus incidentally, but concisely at the beginning in order to enable the reader to examine at once each part of the evidence as it is presented, and see for himself just what bearing it has upon the subject.

It will be seen at once that so far as relates to humidity of the atmosphere, the conclusion is exactly the reverse of the opinion of Hippocrates and of all who have ever written upon the subject; but the reason for the difference of view is easily explained if we consider that all who have preceded me have had in mind the *relative* humidity of the atmosphere, while the facts which I present seem to prove that it is the *absolute* humidity which has causal relations to pneumonia, and the curve for absolute humidity is, approximately, the reverse of the curve for relative humidity. This, however, may be made plainer further on.

TABLE 1.—*Exhibiting the nature and extent of some of the data used relative to Sickness from Pneumonia and Meteorology in Michigan.*

Year.	Number of weekly reports of sickness used.	Temperature.			
		Number of stations.	Observations per day.	Number of days.	Number of observations,
1877	3,320	12	3	365	13,140
1878	3,221	14	3	365	15,330
1879	3,755	19	3	365	20,805
1880	3,991	15	3	365	16,470
1881	3,567	20	3	365	21,900
1882	4,745	22	3	365	21,090
1883	4,458	19	3	365	20,805
1884	3,957	20	3	366	21,960
Total 8 years	31,014				154,500

By table 2 it may be seen that an average of 39 per cent of all reports received stated the presence of pneumonia; this per cent of 31,014 (total reports received as shown in Table 1) is 12,095. If we assume that the average duration of the sickness was three weeks, the number of cases would be about one-third of 12,095—say four thousand cases—if each reporter saw only one case. Each observer must have averaged rather more than one case to a report of the presence of the disease. If the average duration was only two weeks, and each reporter saw only one case, the number of cases would be six thousand. Probably Table 2 and Diagram No. 1 in this article represent at least six thousand cases of sickness from pneumonia in Michigan.

ATMOSPHERIC TEMPERATURE AND PNEUMONIA.

TABLE 2—*By months for a period of eight years, 1877–84, the relation between* SICKNESS *from* PNEUMONIA *and the average temperature of the atmosphere, in Michigan.*

	Average.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept	Oct.	Nov.	Dec.
Sickness from Pneumonia*	39.	62.	66.	62.	56.	42.	27.	18.	14.	18.	23.	35.	48.
Atmospheric Temperature†	46.74	21.43	25.60	31.04	44.48	56.60	65.54	70.68	68.85	62.05	51.34	35.99	27.25

* Indicating what per cent of all reports received stated the presence of pneumonia then under the observation of the physicians reporting. This line is a summary of table 4.

† The average temperature is stated in degrees Fah., and is for groups of several stations in different parts of the State, the stations being stated in the foot note to table 3, of which this line is a summary.

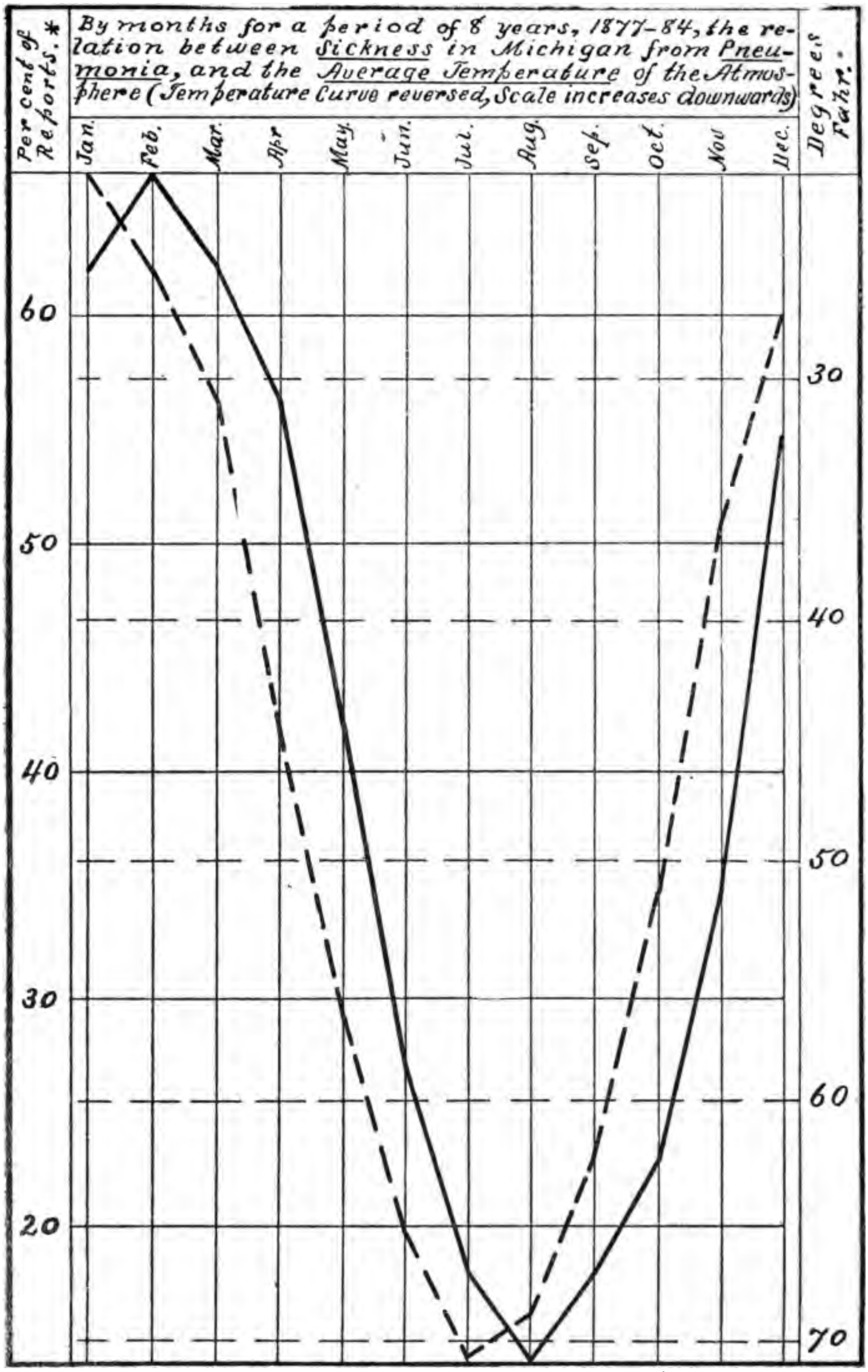
The two lines in table 2 are graphically represented in Diagram No. 1. In drawing the diagram a slight error has occurred which makes the evidence slightly less conclusive than it would be if correct—the continuous line representing pneumonia should end about three-fourths of an inch lower down than it does, the per cent of reports stating the presence of pneumonia in December being 48, as shown in table 2, and this measured by the scale on the left hand margin of the diagram, would be lower than appears in the drawing. But the evidence seems to be conclusive that in some way, directly or indirectly, the sickness from pneumonia is controlled by the temperature of the atmosphere.

THE READING OF THE DIAGRAMS.

For the convenience of those who use the accompanying diagrams, it may be stated that they are to be read with reference to the figures in the right and left-hand margins, usually the numbers indicating the temperature or other meteorological condition being on the right and those representing the sickness or deaths, as the case may be, on the left. Thus, in diagram No. 1, it will be seen that in the month of January, the average atmospheric temperature for eight years was 21.43°, and in the same month the average per cent of reports which stated the presence of pneumonia was 62. In February the average atmospheric temperature was 25.60°, the per cent of reports stating the presence of pneumonia was 66. In July when the curve for atmospheric temperature reached its lowest point (the curve for temperature being reversed) the average atmospheric temperature was 70.68°. In August the per cent of reports which stated the presence of pneumonia was 14.

For an exact reading of the figures, the tables which accompany the paper should be studied; but the relations of the temperature in one month to the sickness in that month or in a succeeding month can best be seen from the diagrams. In these diagrams in which the unit of time is one month and the curve representing sickness is made from reports of all cases under observation, old cases as well as new cases, the sickness curve should coincide with a curve representing a controlling cause of that sickness if the duration of the disease is less than one-half month and the disease has no period of incubation, otherwise the curves may be separated by an interval corresponding (as nearly as the long unit of time will permit) to the average duration of the incubation and the sickness. A curve representing deaths from a given disease should follow a curve representing a condition controlling that disease, the two curves being separated by an interval corresponding (as nearly as the long unit of time will permit) to the average duration of the fatal cases, including the period of incubation, if there is such a period.

DIAGRAM No. 1—*Temperature, and Sickness from Pneumonia in Michigan.*



Sickness from Pneumonia ———. Average Temperature — —.
*Indicating what per cent of all reports received, stated the presence of pneumonia then under the observation of the physicians reporting.
Over 30,000 weekly reports of sickness, and over 150,000 observations of the atmospheric temperature are represented in this diagram.

TABLE 3.—*Exhibiting the Average Atmospheric Temperature by year and months for the Eight Years and for each of the Eight Years 1877–84. (These averages are for groups of several stations in Michigan.)*

Years, Etc.	Temperature, in Degrees Fahr.												
	Months.												
	Average.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 8 years, 1877-84.	46.74	21.43	25.60	31.04	44.48	56.60	65.54	70.68	68.85	62.05	51.34	35.99	27.25
1877 (12 Stations*)....	48.67	19.18	32.27	25.92	46.71	58.24	67.48	72.80	70.52	63.80	52.78	37.57	36.73
1878 (14 Stations*)....	49.24	27.17	29.75	41.46	52.27	54.73	65.18	74.22	70.92	63.99	50.13	38.34	22.74
1879 (19 Stations*)....	46.82	20.86	20.69	33.08	44.29	58.03	64.70	73.16	68.99	57.43	57.43	36.80	26.41
1880 (15 Stations*)....	46.55	34.06	27.93	31.00	44.39	62.27	67.41	69.39	68.07	59.54	46.69	27.24	20.67
1881 (20 Stations*)....	47.22	14.93	19.75	29.36	40.53	62.72	63.32	72.95	71.76	67.99	51.87	37.42	34.03
1882 (22 Stations*)....	47.14	24.32	33.42	34.12	42.65	51.04	64.43	67.84	69.05	61.70	53.53	37.90	25.72
1883 (19 Stations*)....	43.52	15.78	20.03	24.63	43.00	51.37	64.73	68.36	65.41	57.24	46.73	38.10	26.89
1884 (20 Stations*)....	44.72	15.14	20.94	28.78	42.00	54.38	67.04	66.70	66.10	64.72	51.56	34.53	24.77

*Thornville, Kalamazoo, Tecumseh, Detroit 1877–84; Mendon 1877–82; Battle Creek 1877–80 and 1882; Nirvana 1877-9, and first four months of 1880; Reed City, last 8 months of 1880 and 1881–4; Coldwater, Ypsilanti, Woodmere Cemetery 1877–9; Otisville 1878–80 and 1882; Niles 1878-9 and 1881; Marquette, Alpena, Grand Haven, Port Huron, Lansing 1879–84; Washington 1879–83: Benton Harbor 1877–8; Agricultural College 1877 and 1881–84; Petoskey 1878-9; Escanaba 1880–84; Harrisville, Parkville 1881–2; Ann Arbor 1881–4; Traverse City, Hillsdale, Marshall 1882–4; Winfield 1881 and 1883; Hudson and Mallory Lake 1881; Ionia 1883–4; Manistique, Mackinaw City, Swartz Creek 1884.

The evidence shown in this table (3) is graphically represented in Diagrams 1, 2, 3, and 13.

TABLE 4.—*Exhibiting by Months for Eight Years, and for each of the Eight Years, 1877–84, what Per Cent of Weekly Reports of Sickness in Michigan Stated the Presence of Pneumonia.*

Years.	Per Cent of Weekly Reports Which Stated the Presence of Pneumonia.												
	Average.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 8 yrs., 1877-84.	39	62	66	62	56	42	27	17	14	18	23	36	48
Av. for 8 yrs., 1878-85.	38	59	65	62	55	41	26	17	14	18	23	33	45
Av. for 4 yrs., 1882-85.	34	55	58	57	51	37	25	15	12	16	22	30	39
1877..................	40	70	67	63	55	38	23	15	14	15	23	40	53
1878..................	42	54	60	61	56	45	33	22	18	18	28	40	55
1879..................	43	69	80	74	62	40	26	19	15	23	22	29	51
1880..................	41	62	73	72	62	43	24	16	13	18	23	39	49
1881..................	41	69	73	62	61	51	28	19	14	19	21	36	47
1882..................	39	58	63	60	58	46	34	17	12	19	25	33	47
1883..................	39	56	62	64	55	46	27	16	16	21	23	34	44
1884..................	29	54	49	43	39	24	18	16	11	10	21	29	34
1885..................	31	50	58	60	50	31	19	11	10	12	17	22	31

NOTES RELATIVE TO TABLE 4.

Weekly reports are made by the Health Officers of cities and villages, and by regular correspondents to the Michigan State Board of Health. While these do not report all the cases of sickness in the State, they are sufficient in number and well enough distributed to give very satisfactory data for the State as a whole, because of the great probability that one hundred observers in active general practice in as many different parts of the State will, on an average, see an average of the sickness throughout the State.

The evidence shown in this table in line "Average for 8 years, 1877-84," is graphically represented in Diagram No. 1.

The evidence shown in this table in line "Average for 8 years, 1878-85," is graphically represented in Diagram No. 4.

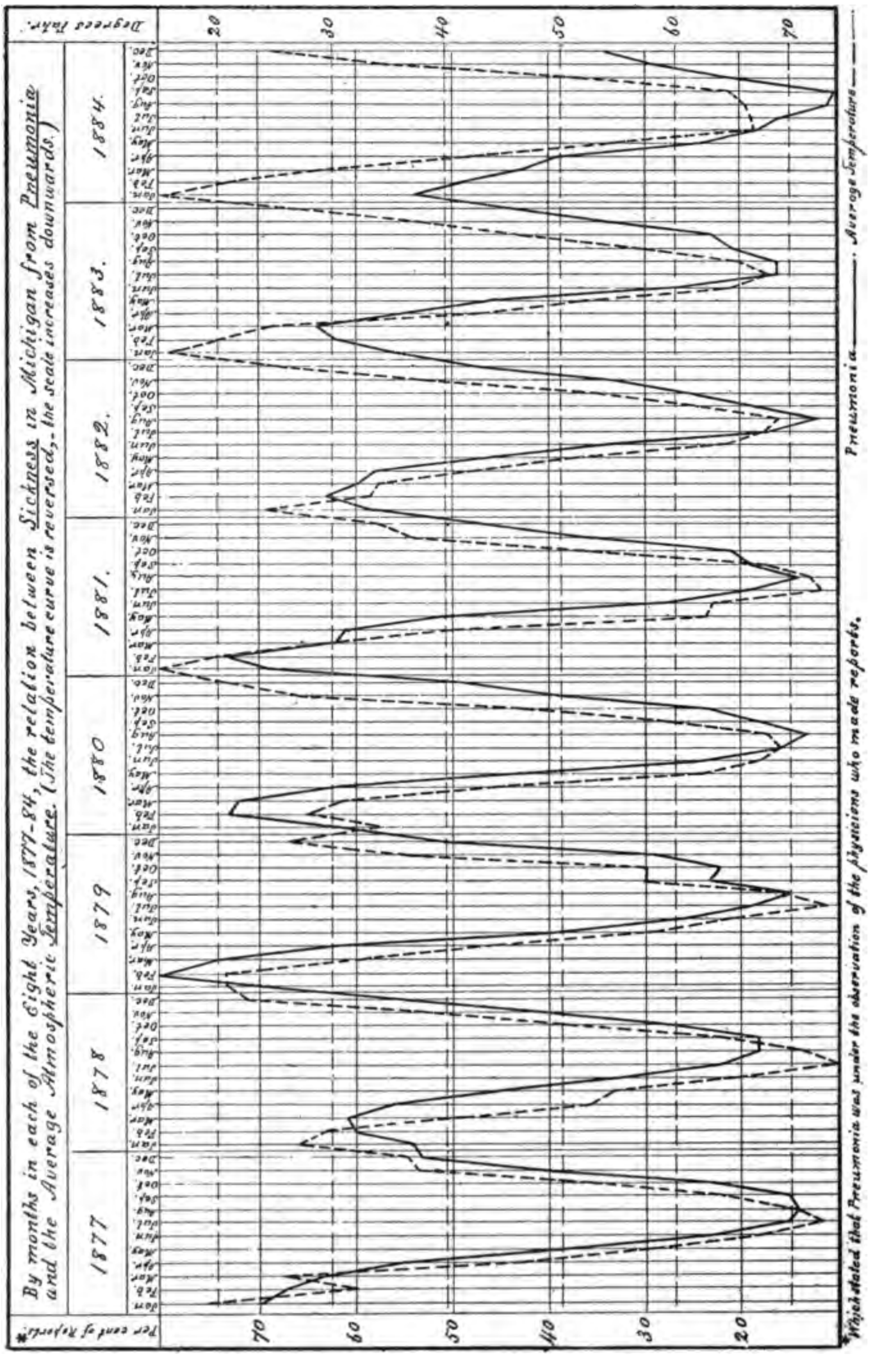
The evidence shown in this table in line "Average for 4 years, 1882-85," is graphically represented in Diagram No. 6.

The evidence shown in this table in "each of 8 years, 1877-84," is graphically represented in Diagram No. 2.

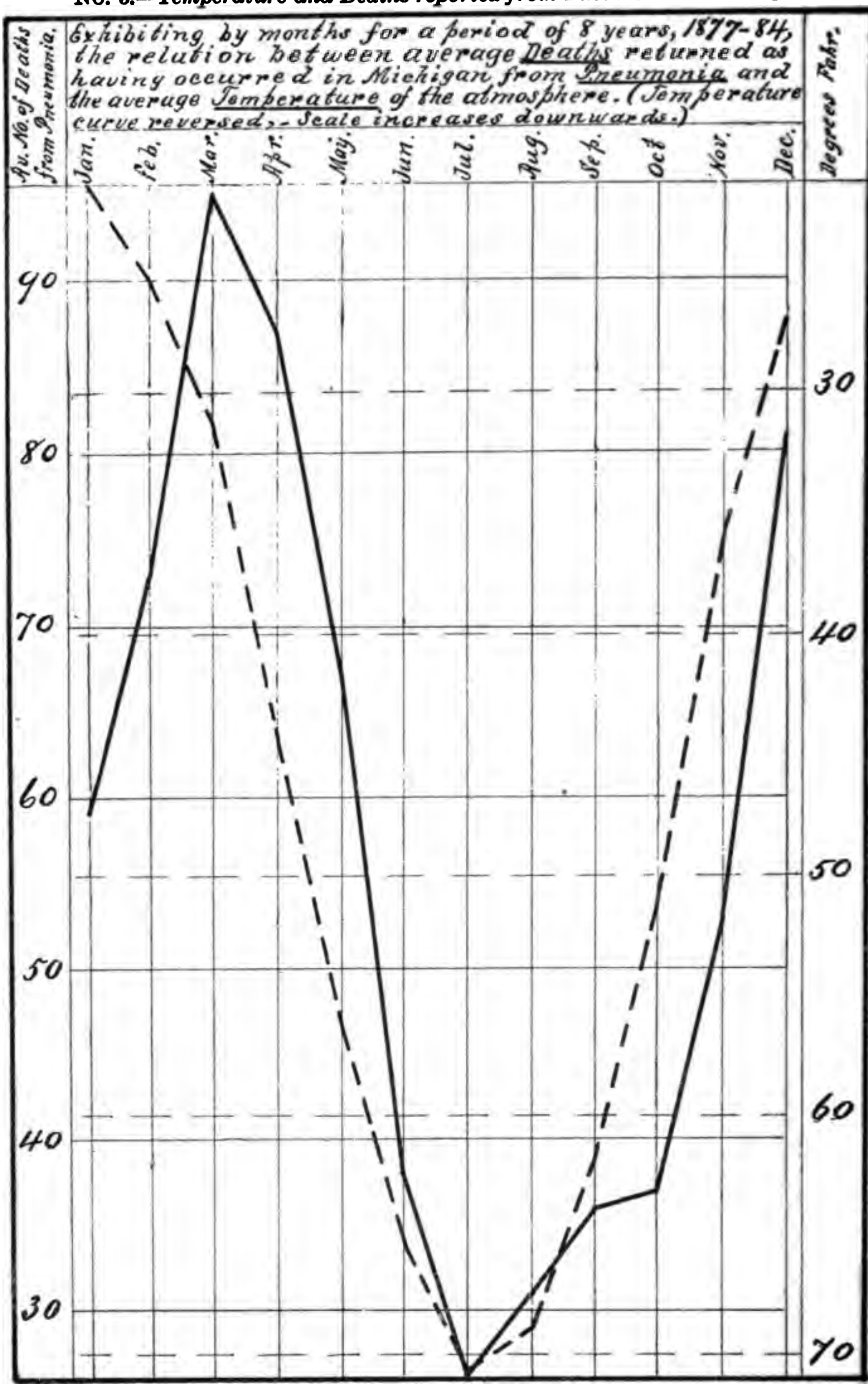
THE ARRANGEMENT OF TABLES IN THIS ARTICLE.

The plan of presenting the evidence in this article is, concerning each branch of the subject, to give first the most complete general statement of it, in the form of a diagram or a consolidated table, and to follow this with the tables of details which may be studied by those who desire to master the subject in detail. Other readers may well omit such tables if they will carefully consider the evidence in the diagrams which, in most cases, are accurately drawn to scale, and may be easily read, as explained on page 251.

No. 2—Temperature, and Sickness from Pneumonia in Michigan, in each month during eight years.



No. 3.—*Temperature and Deaths reported from Pneumonia in Michigan.*



Average Deaths from Pneumonia —— Average Temperature — —
*Deaths not all returned. A much greater proportion of deaths are returned for the later than for the earlier months in each year.

TABLE 5.—*Exhibiting by months for the eight years, and for each of the eight years 1877–84, the number of deaths returned as having occurred in Michigan from Pneumonia.*

Years, etc.	For each year.	Average month	Deaths in the several Months.											
			Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
Av. for 8 yrs., 1877–84.......		57	59	73	95	87	67	38	26	31	36	37	53	81
Av. for 7 yrs., 1878–84.......		60	59	75	100	91	71	40	29	33	37	39	56	87
1877............	463	39	58	56	64	60	39	24	14	23	26	26	35	38
1878............	462	39	36	37	59	54	37	30	15	19	22	35	53	65
1879............	700	58	44	92	114	102	59	36	30	31	42	25	45	80
1880............	811	68	56	82	111	113	79	37	29	36	51	44	68	105
1881............	802	67	77	88	126	100	70	37	39	29	47	55	43	91
1882............	733	61	59	65	84	82	94	58	29	29	36	43	57	97
1883............	736	61	76	61	97	104	89	40	30	42	27	41	53	76
1884............	766	64	68	101	106	83	67	39	34	42	34	30	70	92

The evidence shown in the line in this table (5), "Average for eight years, 1877–84," is graphically represented in Diagram No. 3.

The evidence shown in the line in this table, "Average for seven years, 1878–84," is graphically represented in Diagram No. 5.

TABLE 6.—*By months for a period of 8 years, 1878–85, the relation between* SICKNESS *in Michigan from* PNEUMONIA, *and the average Relative Humidity of the Atmosphere.*

	Annual Av.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Sickness from Pneumonia*............	38	59	65	62	55	41	26	17	14	18	25	33	45
Average Relative Humidity †........	75.1	80.7	79.5	76.1	68.2	67.5	71.7	72.1	73.9	75.0	76.2	78.9	82.1

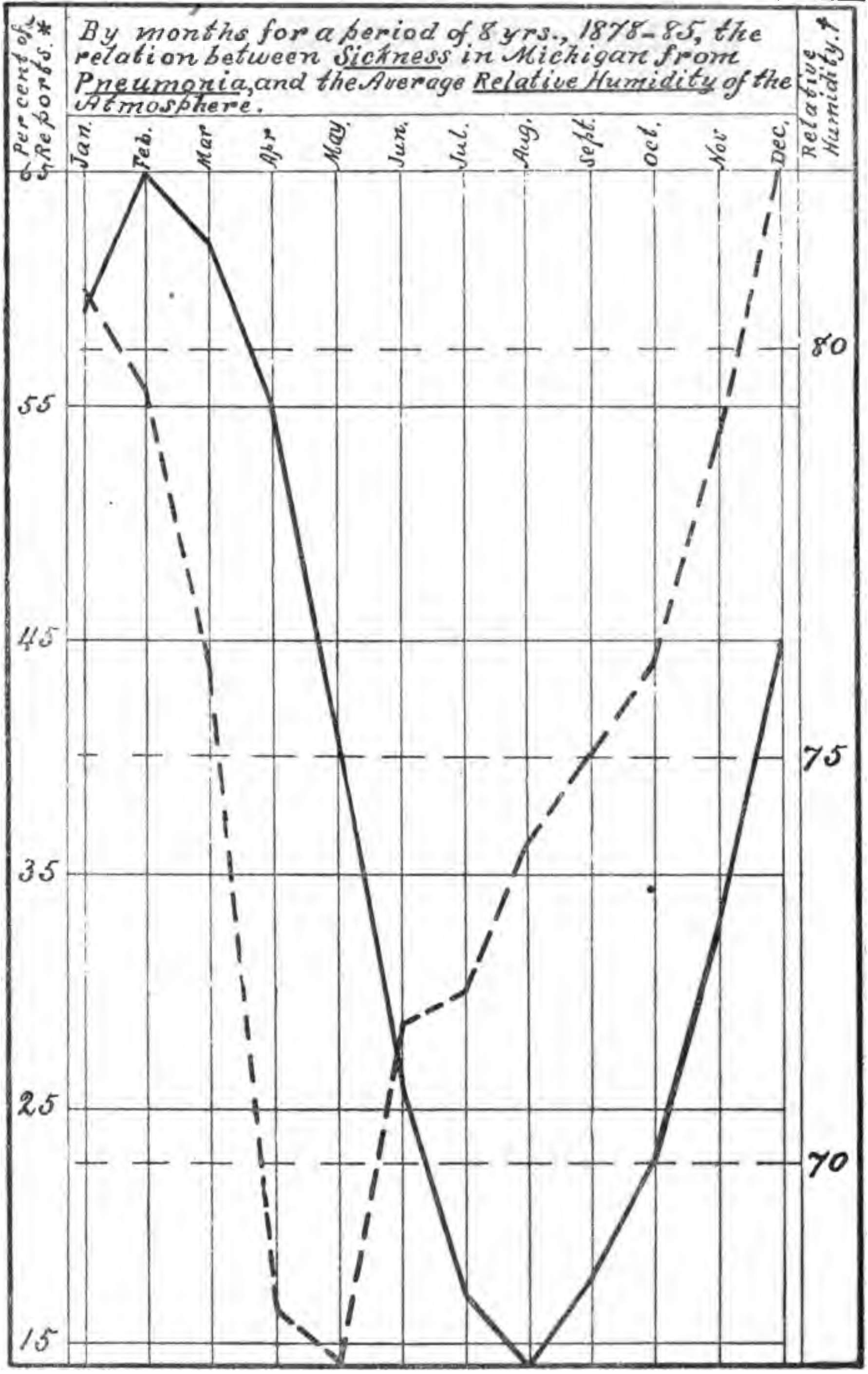
* Indicating what per cent of all reports received, stated the presence of Pneumonia then under the observation of the physicians reporting.

† Per cent of saturation of the Atmosphere with vapor. The average is for groups of several stations in different parts of the State.

The two lines in Table 6 are graphically represented in Diagram No. 4.

The evidence concerning absolute humidity and its relations to pneumonia, is exhibited in Table 23, and other tables, and in Diagram No. 14, after much of the other evidence has been presented.

NO. 4.—*Relative Humidity, and Sickness from Pneumonia in Michigan.*



Sickness from Pneumonia ——— . . Relative Humidity — — —.

*Indicating what per cent of all reports received, stated the presence of pneumonia then under the observation of the physicians reporting.

† Per cent of Saturation of the Atmosphere with vapor.

No. 5.—*Relative Humidity, and Deaths reported from Pneumonia in Michigan.*

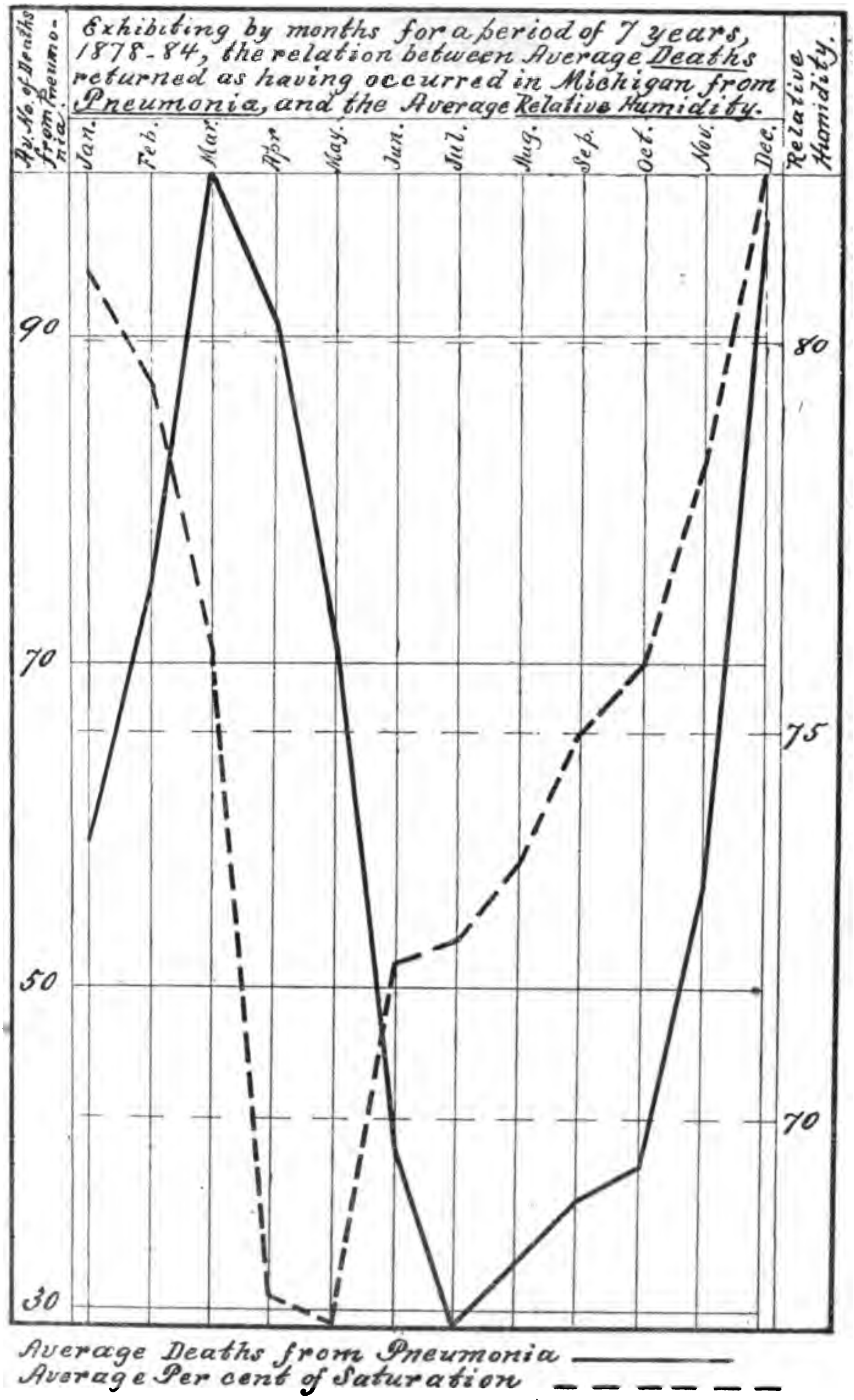


TABLE 7.—*Exhibiting the Average Relative Humidity by Year and by Months for the Seven Years and for each of the Seven Years 1878–84. (These Averages are for groups of several stations in Michigan).*

Years, etc.	Per cent of Saturation,—Relative Humidity.												
	Average.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 7 yrs., 1878–84	75.0	80.9	79.4	76.0	67.7	67.3	72.0	72.3	73.3	75.0	75.9	78.4	82.1
Av. for 8 yrs., 1878–85	75.1	80.7	79.5	76.1	68.2	67.5	71.7	72.1	73.9	75.0	76.2	78.9	82.1
1878 (11 Stations*)...	77	83	80	79	71	69	71	76	74	76	75	79	86
1879 (16 Stations*)...	74	82	80	75	66	63	70	70	70	76	74	80	83
1880 (14 Stations*) ..	73	79	75	70	67	65	70	74	75	74	75	77	81
1881 (17 Stations*)...	75	79	81	79	68	67	72	69	69	74	80	79	80
1882 (22 Stations*)...	76	81	77	77	68	67	71	70	81	77	76	79	82
1883 (18 Stations*)...	75	82	81	75	67	70	77	76	71	75	76	76	80
1884 (19 Stations*)...	75	80	82	77	67	70	73	71	73	73	75	79	83
1885 (18 Stations*)...	76	80	80	77	72	69	70	71	78	75	79	82	82

* Thornville, Tecumseh, Detroit 1878–84; Kalamazoo 1878-83; Mendon 1878–82; Otisville 1878–80 and 1882; Nirvana, Woodmere Cemetery 1878–9; Nirvana and Reed City 1880; Ann Arbor, Reed City 1881–4; Niles 1878–9 and 1881; Marquette, Alpena, Grand Haven, Port Huron, Lansing 1879–84; Agr'l College 1878 and 1881–4; Escanaba 1880–84; Washington 1880–83; Coldwater 1878; Petoskey 1879; Mallory Lake and Hudson 1881; Marshall, Hillsdale, Traverse City 1882–84; Hastings, Harrisville 1882; Winfield 1883; Battle Creek 1878–9 and 1882; Manistique, Mackinaw City, Ionia, Swartz Creek 1884.

The evidence shown in Table 7 is graphically represented in Diagrams 4 and 5.

TABLE 8.—*Exhibiting the Average Atmospheric Pressure by year and months for the Eight Years, and for each of the Eight Years, 1877–84.* (*These averages are for groups of Several Stations in Michigan.**)

Years, Etc.	Average Atmospheric Pressure.—Inches of Mercury.												
	Average.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 8 yrs., 1877-84.	29.205	29.243	29.263	29.179	29.145	29.181	29.149	29.167	29.198	29.234	29.242	29.233	29.232
1877 (6 Stations*)	29.166	29.218	29.265	29.140	29.128	29.179	29.091	29.124	29.112	29.178	29.152	29.163	29.246
1878 (5 Stations*)	29.232	29.279	29.217	29.206	29.059	29.198	29.213	29.254	29.209	29.336	29.261	29.273	29.276
1879 (12 Stations*)	29.196	29.211	29.214	29.205	29.164	29.219	29.164	29.133	29.147	29.229	29.262	29.192	29.217
1880 (11 Stations*)	29.218	29.209	29.184	29.270	29.127	29.196	29.170	29.192	29.249	29.235	29.235	29.320	29.230
1881 (10 Stations*)	29.201	29.265	29.279	29.032	29.172	29.225	29.129	29.194	29.227	29.168	29.267	29.215	29.238
1882 (19 Stations*)	29.196	29.225	29.370	29.191	29.198	29.167	29.042	29.157	29.152	29.241	29.174	29.265	29.175
1883 (16 Stations*)	29.209	29.243	29.349	29.166	29.145	29.119	29.092	29.159	29.252	29.257	29.293	29.203	29.226
1884 (17 Stations*)	29.225	29.296	29.225	29.223	29.168	29.144	29.292	29.119	29.235	29.229	29.288	29.233	29.251

* The Stations represented in the lines for Average Atmospheric Pressure for the years 1877–84 in the above table are the following:—Detroit for the 7 years 1878–84; Marquette, Alpena, Grand Haven, Port Huron, Lansing 1879–84; Kalamazoo 1877–82; Agricultural College 1877–78 and 1881–84; Tecumseh 1879–80 and 1882–84; Washington 1879–80 and 1882–83; Escanaba 1880 and 1882–84; Otisville 1880 and 1882; Ann Arbor 1881–84; Mendon 1881–83; Traverse City 1882–84; Port Austin and Marshall 1883 and 1884; Hillsdale 1882 and 1883; Manistique, Mackinaw City, Thornville and Ionia for 1884; Reed City, Hastings and Harrisville for 1882; Benton Harbor 1877–8; Battle Creek 1877; Ypsilanti 1877 and 1879; Woodmere 1877-9; Nirvana 1879.

The evidence shown in Table 8 has been graphically represented in a diagram and carefully studied; but the diagram is not printed because no close relation to sickness from pneumonia is shown by it, although the month of greatest pressure is the month of most sickness, and the time of least sickness is after the time of least pressure, and there is a general relationship of this nature.

TABLE 9.—*Exhibiting by Year and Months for the four years, and for each of the four years,* 1882–85, *the Average Daily Range of Atmospheric Pressure. (These averages are for Groups of several Stations in Michigan.*)*

Years.	Average.	Average Daily Range of Barometer for Months.											
		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 4 yrs., 1882-85.	.214	.325	.294	.298	.208	.171	.150	.125	.136	.156	.203	.228	.272
1882 (8 Stations*).....	.211	.338	.330	.362	.192	.158	.163	.123	.095	.148	.200	.189	.225
1883 (16 Stations*)....	.229	.335	.338	.285	.180	.200	.157	.130	.129	.198	.226	.309	.266
1884 (18 Stations*)....	.206	.307	.288	.277	.205	.177	.116	.127	.154	.103	.203	.232	.281
1885 (18 Stations*)....	.209	.319	.217	.267	.253	.148	.165	.118	.165	.173	.182	.181	.314

* Marquette for 1882–4; Escanaba, Traverse City, Reed City, Grand Haven, Lansing, Ann Arbor, and Tecumseh for 1882–5; Alpena, Port Huron, Agricultural College, Detroit, and Marshall for 1883–5; Washington and Mendon for 1883; Manistique and Mackinaw City, Thornville, and Ionia for 1884–5; Harrisville, Swartz Creek for 1885; Port Austin for 1883–4.

The evidence shown in Table 9 in line for "Average for 4 years, 1882–5," is graphically represented in Diagram No. 6.

TABLE 10.—*By months for a period of four years,* 1882–85, *the relation of* SICKNESS *in Michigan from* PNEUMONIA, *to the Average Daily* RANGE *of Atmospheric Pressure.*

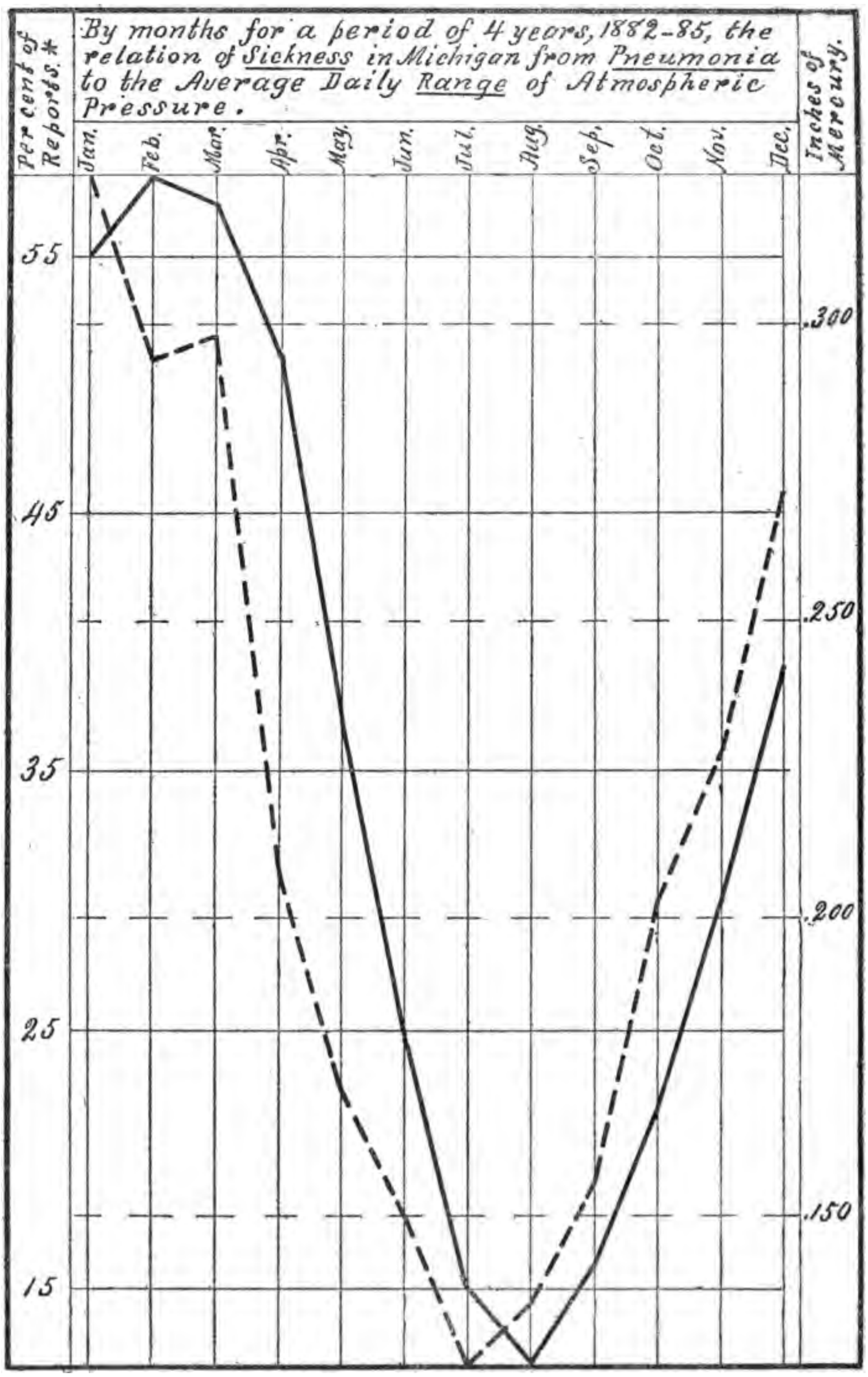
	Annual Average	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Sickness from Pneumonia*..............	33	55	58	57	51	37	25	15	12	16	22	30	39
Average Range of Pressure †..........	.214	.325	.294	.298	.208	.171	.150	.125	.136	.156	.203	.228	.272

* Indicating what per cent of all reports received stated the presence of Pneumonia then under the observation of the physicians reporting.

† The average daily range of atmospheric pressure, in inches of mercury, is for groups of several stations in different parts of the State.

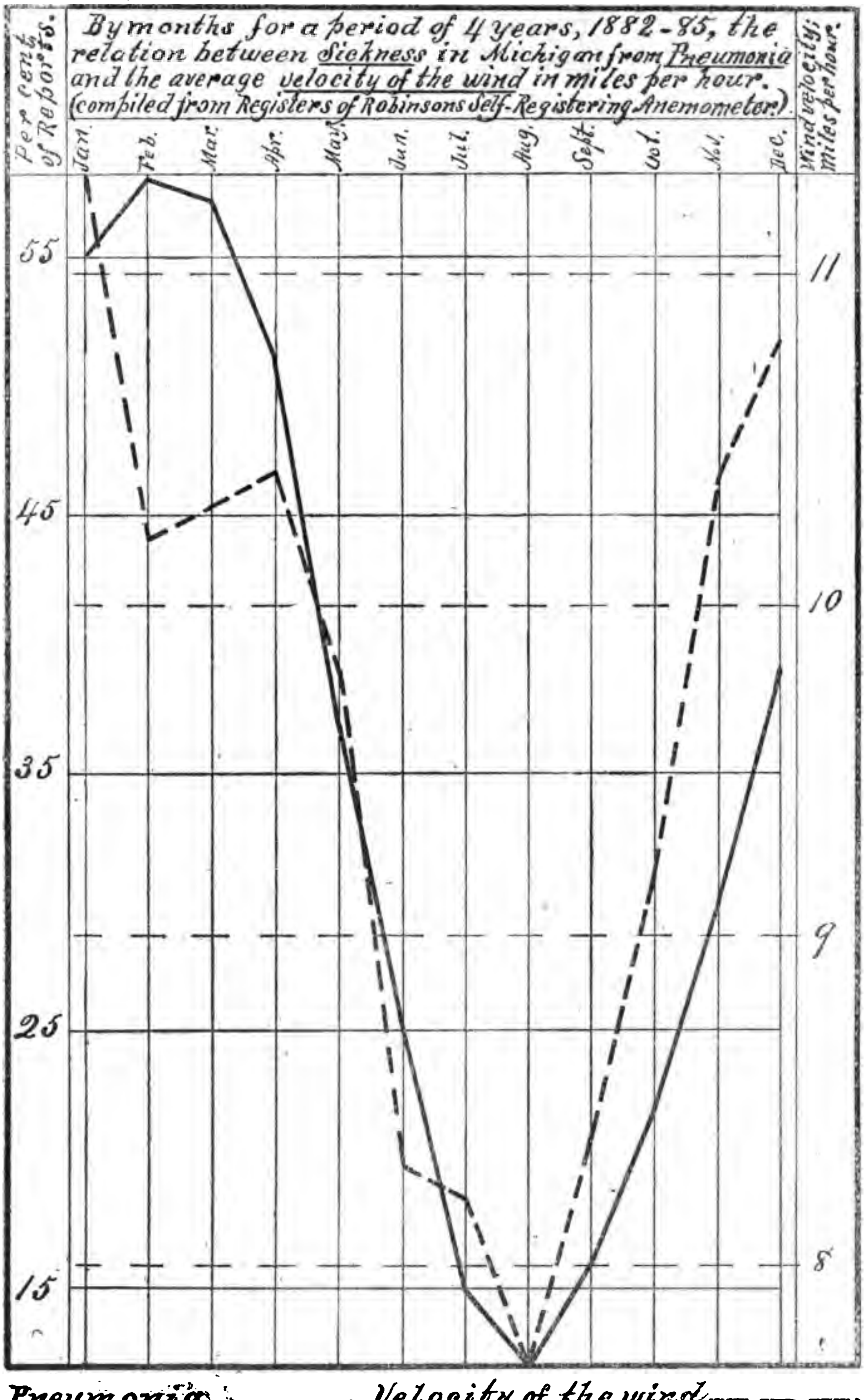
The two lines in table 10 are graphically represented in diagram No. 6.

No. 6.—*Daily Range of Barometer, and Sickness from Pneumonia.*



Sickness from Pneumonia ——— . Av. daily range of Barometer — — —.
* Which stated that Pneumonia was under the observation of the physicians who made reports.

No. 7.—*Velocity of the Wind, and Sickness from Pneumonia in Michigan.*



Pneumonia ———. Velocity of the wind — — —.

TABLE 11.—*By Months for a Period of 4 years, 1882–85, the relation of* SICKNESS *in Michigan from* PNEUMONIA *to the* AVERAGE VELOCITY OF THE WIND *in Miles per Hour. Compiled from Registers of the Robinson's Self-Registering Anemometer.*

	Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Sickness from Pneumonia*	33	55	58	57	51	37	25	15	12	16	22	30	39
Average Velocity of the Wind †	9.6	11.3	10.2	10.3	10.4	9.8	8.3	8.2	7.7	8.4	9.2	10.4	10.8

* Indicating what per cent of all reports received, stated the presence of pneumonia then under the observation of the physicians reporting.
† The average velocity of the wind, in miles per hour, is for groups of several stations in different parts of the State.

The two lines in Table 11 are graphically represented in Diagram No. 7.

TABLE 12.—*Average Velocity of the Wind per Hour, by Months, for each of the years, and for the* 4 *years,* 1882–85, *from Registers of the Robinson's Self-Registering Anemometer. These Averages are for Groups of Several Stations in Michigan.*

	Years.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 4 yrs., 1882–85	9.6	11.3	10.2	10.3	10.4	9.8	8.3	8.2	7.7	8.4	9.2	10.4	10.8
1882 (8 Stations*)	9.6	11.5	11.7	11.8	11.1	10.1	8.7	8.5	6.9	7.5	8.6	8.6	10.1
1883 (8 Stations*)	9.9	10.9	10.9	10.3	9.9	10.7	8.8	8.7	7.9	8.3	9.3	12.6	10.8
1884 (9 Stations*)	9.3	11.1	9.2	8.8	10.1	9.4	6.8	7.9	7.9	9.0	10.5	10.3	10.8
1885 (9 Stations*)	9.4	11.8	9.0	10.2	10.4	9.0	8.7	7.6	8.1	8.8	8.2	9.9	11.6

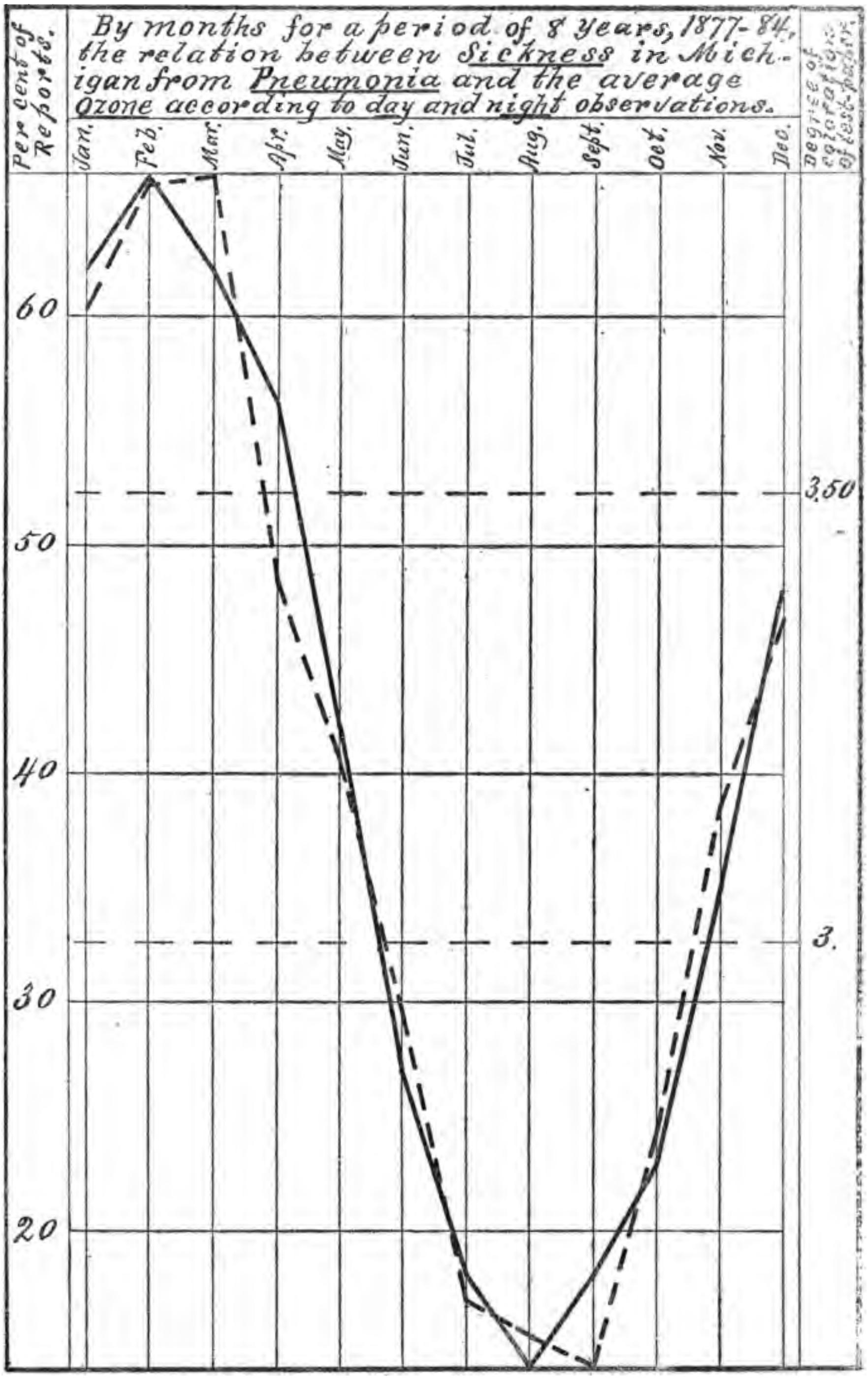
* The Stations represented in the lines for Average Velocity of the Wind for the years 1882–85 are the following: Marquette, Escanaba, Alpena, Grand Haven, Port Huron, Lansing, Ann Arbor and Detroit. Mackinaw City for 1884–5.

TABLE 13.—*By months for a period of eight years,* 1877–84; *the relation between* SICKNESS *in Michigan from* PNEUMONIA *and average* OZONE, *according to day and night observations.*

	Annual Average	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Sickness from Pneumonia	39	62	66	62	56	42	27	17	14	18	23	36	48
Average day and night Ozone combined	3.14	3.70	3.84	3.85	3.40	3.20	2.92	2.60	2.56	2.53	2.79	3.15	3.36

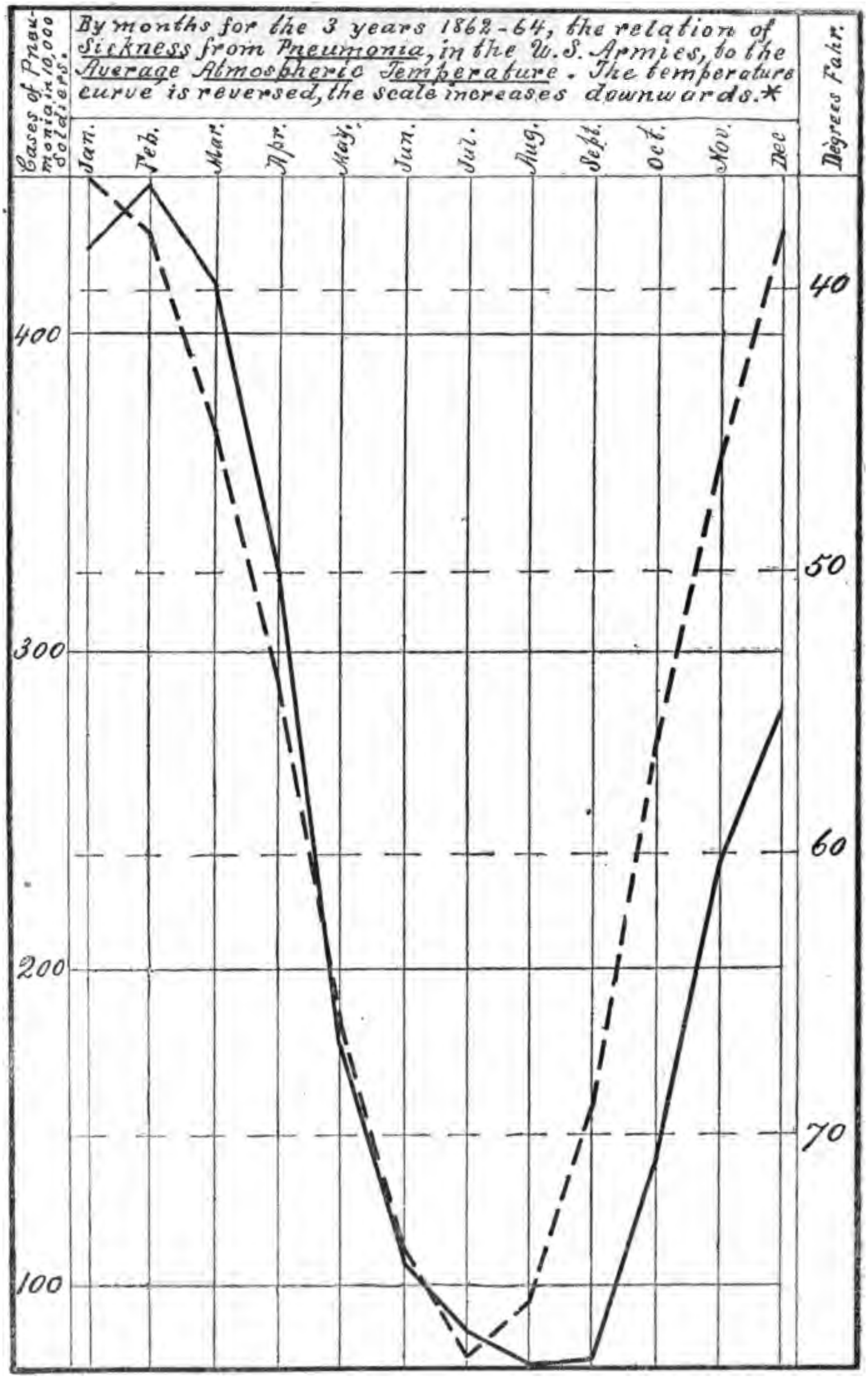
The two lines in table 13 are graphically represented in diagram No. 8.

No. 8.—*Atmospheric Ozone, and Sickness from Pneumonia in Michigan.*



Pneumonia ——. Ozone, day and night — — - -

No. 9.—*Temperature, and Sickness from Pneumonia in U. S. Armies*, 1862–4.



Sickness from Pneumonia ———. Average Temperature — — —

* The temperature curve is made from the normals at six stations representing approximately the localities occupied by the armies of the United States.

TABLE 14.—*By Months (made of uniform length—30 days each) for the 3 years,* 1862–64, *the relation of* SICKNESS *from* PNEUMONIA *in the* U. S. ARMIES, *to the Average Atmospheric Temperature.*

	Average.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Sickness from Pneumonia *	240	442	463	429	334	184	112	87	76	80	144	242	290
Atmospheric Temperature†	56	36	38	45	54	66	74	78	76	69	56	46	38

* Average numbers of cases sick with Pneumonia per hundred thousand soldiers ("Mean Strength") of the White Troops. This line of figures is graphically represented in Diagram No. 9; but since the diagram was made it has been found that by reason of an error the figures represented were slightly incorrect. The figures in this table are correct, and a curve representing them conforms even more closely to the temperature curve than does the one given in the diagram. The figures in the upper left corner of Diagram No. 9 should be 100,000 instead of 10,000.

† The meteorological data for just the years 1862-4 not being attainable, the Average Temperature for a series of years (3 to 30) at several representative stations, is used instead.

TABLE 15.—*Exhibiting by months (reduced to uniform length—30 days each) during 3 years 1862–4, the Number of Cases of* SICKNESS *from* PNEUMONIA *per 100,000 Soldiers ("Mean Strength") of the White Troops of the* U. S. ARMIES *during the war. Compiled from the Medical and Surgical History of the War of the Rebellion, Part First, Medical Volume.*

		Months.											
Years.	Average Month.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1862	296	547	550	452	406	223	123	111	82	94	197	358	412†
1863	216	391	481	407	303	162	100	69	65	82	118	181	236
1864	208	387*	359	427	294	167	112	81	81	65	116	188	223
Sum	720	13,025	13,090	12,086	10,003	552	335	261	228	241	431	727	871
Average for three years‡	240	442	463	429	334	184	112	87	76	80	144	242	290

*This was the "cold New Years;" but January as a whole was warm. The data relative to temperature used in connection with this table are for a series of years at six stations, representing approximately the location of the U. S. Troops during the 3 years 1862-64, and therefore do not show the facts for any single year.

† December, 1862, was a comparatively warm December.

‡ The evidence shown in this average line is graphically represented in Diagram No. 9 in connection with a curve representing the temperature.

TABLE 16.—*Exhibiting by Months (not reduced to uniform length) the Numbers of Cases of Sickness and of Deaths from Pneumonia in the White Troops of the U. S. Armies, together with the "Mean Strength" of those Troops, for the 3 years* 1862–4, *during the War. Compiled from the Medical and Surgical History of the War of the Rebellion, Part First, Medical Volume.*

Months.	1862.			1863.			1864.		
	Mean Strength.	Cases.	Deaths.	Mean Strength.	Cases.	Deaths.	Mean Strength.	Cases.	Deaths.
January	352,760	1,941	477	799,041	3,000	782	604,432	2,417	400
February	327,734	1,626	361	787,477	3,313	790	636,148	2,210	548
March	328,878	1,471	361	789,244	3,131	754	680,034	2,999	914
April	410,416	1,606	259	751,750	2,156	577	696,539	2,046	828
May	408,031	877	164	714,792	1,130	241	641,376	1,104	359
June	388,693	452	101	637,734	590	128	615,258	700	202
July	444,580	483	91	567,760	410	91	567,846	477	196
August	376,652	291	60	603,105	402	72	556,006	467	129
September	498,959	424	43	575,675	473	90	540,578	354	80
October	651,091	1,221	124	589,056	721	110	560,661	670	111
November	685,804	2,256	487	596,223	1,081	187	556,536	1,044	220
December	782,332	3,086	692	630,834	1,539	254	569,591	1,319	313
Sums	....	15,734	3,220	....	17,946	4,076	....	15,807	4,300
Average per month	471,328	1,311	268	670,224	1,496	340	602,167	1,317	358

The Monthly Average Mean Strength for the three years, 1862–4, is 581,240.
The total number of Cases of Sickness from Pneumonia for the three years is 49,487.
The Average number of Cases of Pneumonia per month for the three years is 1,375.
The total number of Deaths from Pneumonia for the three years is 11,596.
The Average number of Cases of Sickness per month per 10,000, Mean Strength, is for each year as follows: for 1862, 28; for 1863, 22; for 1864, 22; for the three years, 24.
The per cent of Deaths to Cases is for the three years 23.43; for 1862 it is 20.47; for 1863 it is 22.71; for 1864 it is 27.20.

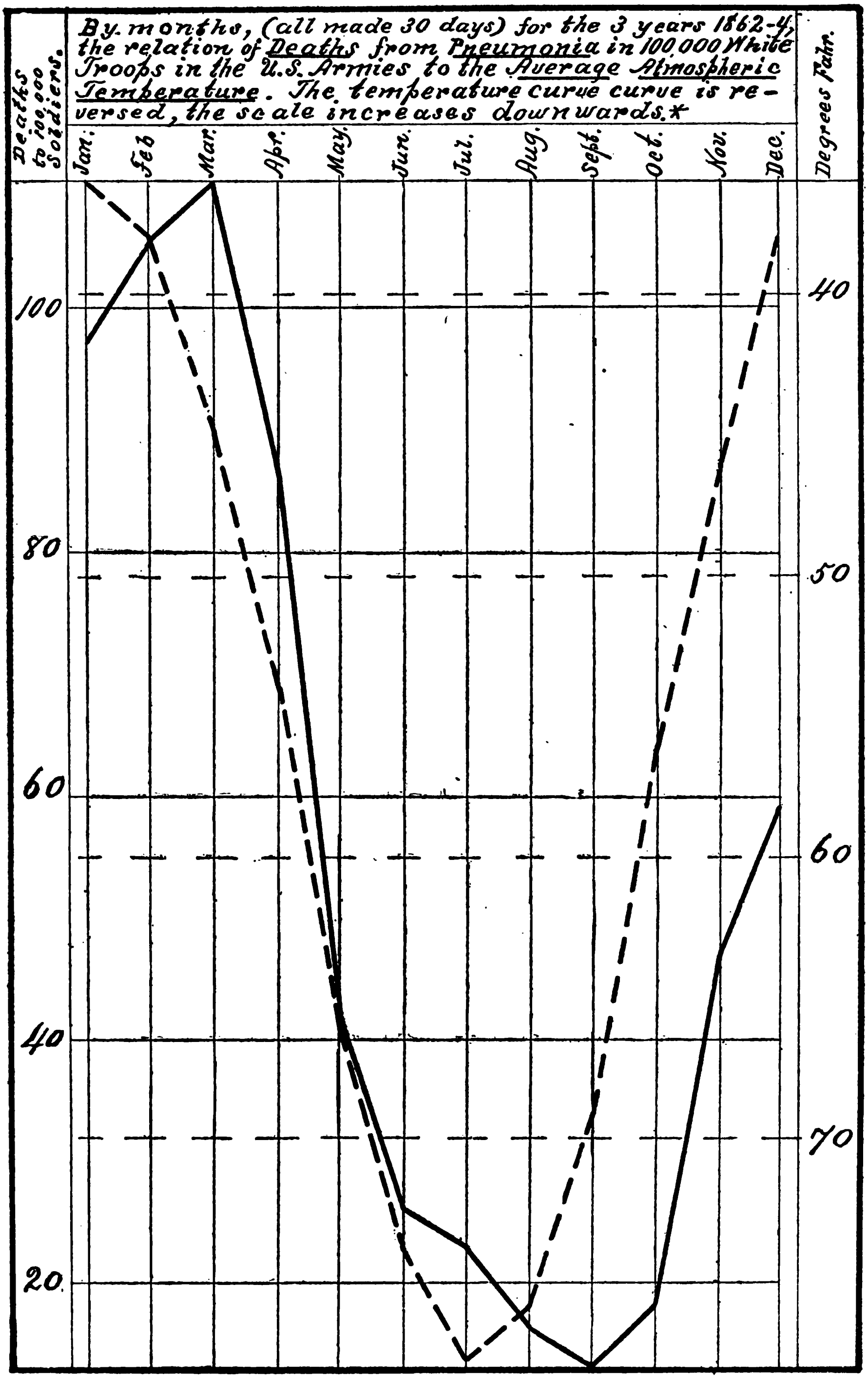
TABLE 17.—*Exhibiting, by Months for a series of Years,* the Average Atmospheric Temperature at six Stations, and at each of six Stations, representing approximately the Latitude and Longitude of the Aggregate Forces of the Armies of the United States in the War of the Rebellion.*

Stations.	No. of Years and Months.	Period.	Months.											
			Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Cincinnati College, Ohio	20-2	1835-55	33	34	34	34	64	71	77	74	66	53	43	34
St. Louis, Mo	23	1833-55	33	35	44	58	66	74	79	77	69	55	41	34
Memphis, Tenn	3	1850-52	42	46	55	59	69	77	80	79	73	58	53	40
Nashville, Tenn	5	1840-44	38	41	49	62	68	77	80	76	71	55	45	40
Ft. Monroe, Va	30	1825-54	37	42	48	56	66	74	78	77	72	62	51	43
Philadelphia, Pa	32	1825-56	32	32	41	52	63	72	76	73	64	55	44	35
Average Temperature for six Stations			36	38	45	54	66	74	78	76	69	56	46	38

The Average Temperature line of this table is graphically represented in Diagrams 9 and 10.

*The meteorological data for just the years 1862-4 not being readily obtainable, the Average Temperature for a longer, although for a different series of years, is used instead.

No. 10.—*Temperature, and Deaths from Pneumonia in U. S. Armies,* 1862–4.



Deaths from Pneumonia ——— . Average Temperature — — —

*The temperature curve is made from the normals at six stations representing approximately the localities occupied by the armies of the United States in the war of the rebellion.

TABLE 18.—*By months (all made 30 days) for the 3 years 1862–4, the relation of* DEATHS *from* PNEUMONIA *in* 100,000 *White Troops in the U. S. Armies to the Average Atmospheric Temperature.*

	Average.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average number of deaths from Pneumonia*	52	95	104	107	84	40	25	21	15	12	17	45	56
Average Atmospheric Temperature†	56	36	38	45	54	66	74	78	76	69	56	46	38

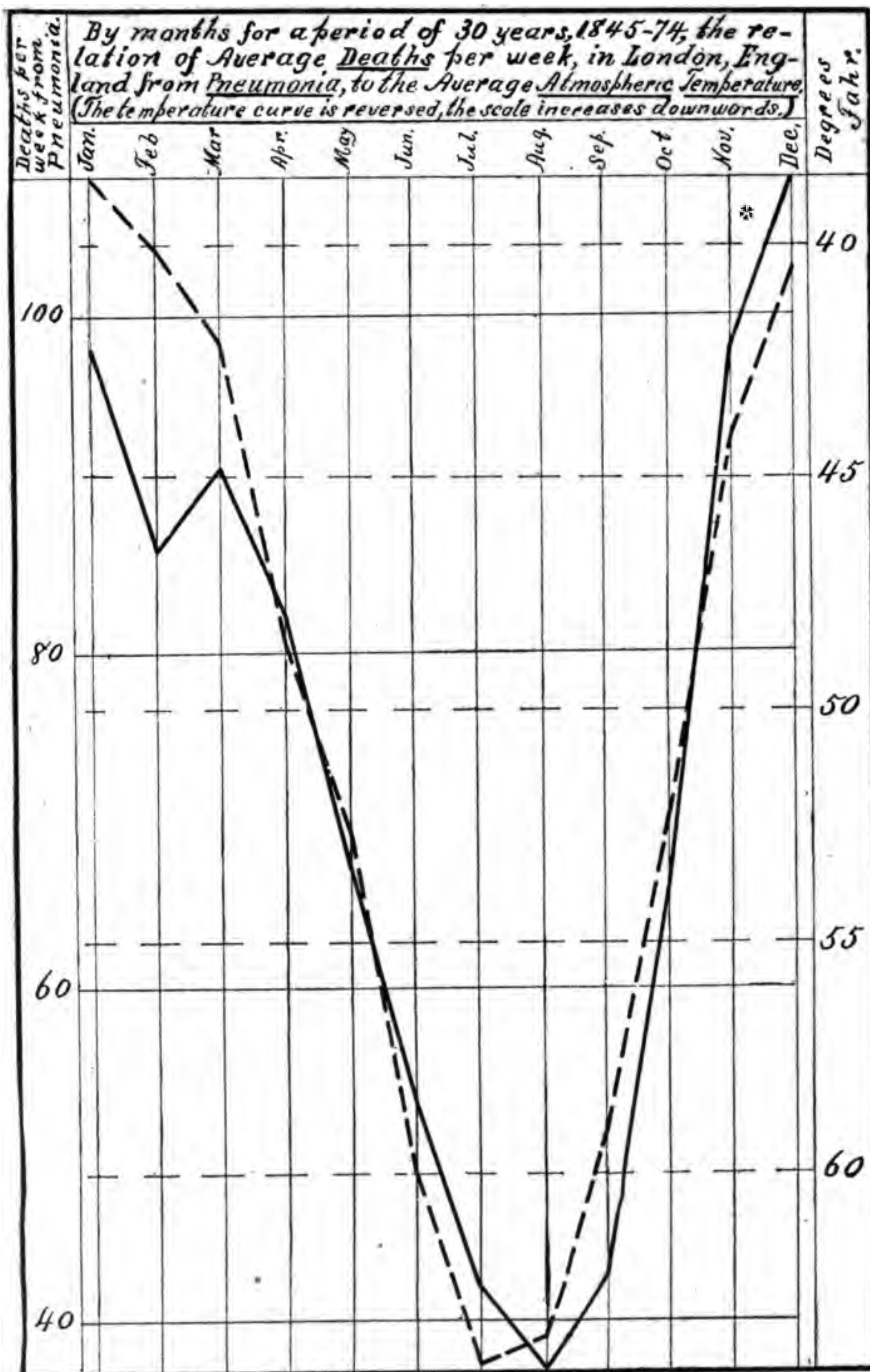
TABLE 19.—*Exhibiting by Months (reduced to uniform length—30 days each) during the* 3 *years* 1862–4, *the number of* DEATHS *from* PNEUMONIA *per* 100,000 *soldiers ("Mean Strength") of the White Troops of the U. S. Armies during the war. Compiled from the Medical and Surgical History of the War of the Rebellion, Part First, Medical Volume.*

Years.	Average Month.	Months.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1862	58.51	130.88	117.99	106.27	63.11	38.89	25.98	19.84	15.45	8.62	18.43	71.01	85.59
1863	45.37	94.73	107.53	92.44	76.75	32.61	20.07	13.97	10 48	14.17	16.53	28.85	36.26
1864	51.43	59.78	86.37	122.53	111.76	48.46	28.95	28.89	19.29	12.88	16.84	34.60	46.75
Sums	......	285.39	311.89	321.24	251.62	119.96	75.00	62.70	45.22	35.67	51.80	134.46	168.60
Av. for three years*	51.77	95.13	103.96	107.08	83.87	39.99	25.00	20.90	15.07	11.89	17.27	44.82	56.20

* Number of deaths per 100,000 (" mean strength") White troops. The evidence shown in this average line is graphically represented in Diagram No. 10, in connection with a curve representing the temperature. The curve representing Deaths in the diagram (No. 10) was made from figures which were later found to be slightly incorrect. The figures in this table are correct, and a curve representing them, while varying almost imperceptibly from the one given in the diagram, would conform as closely, if not more closely, to the temperature curve.

† The Meteorological data for just the years 1862–4 not being obtainable, the Average Temperature for a long series of years (3 to 30) at several representative stations, is used instead.

No 11.—*Temperature, and Deaths from Pneumonia, in London, England.*



* Perhaps a greater proportion of deaths are returned for the later than for the earlier months in each year?

TABLE 20.—*By months, for a period of thirty years, the relation of average* DEATHS *per week, from* PNEUMONIA, *in London, England, to the average Atmospheric Temperature.**

	Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average Deaths per week from Pneumonia	73	98	86	91	82	67	53	42	37	43	66	98	108
Average Atmospheric Temperature	51	38.6	40.1	42.2	48.6	52.7	60.0	61.2	63.5	59.1	52.2	44.2	40.5

* The data used in compiling this table are taken from the Journal of the Scottish Meteorological Society, July, 1874–July 1875, pp. 253 and 263.

The two lines in Table 20 are graphically represented in Diagram No. 11.

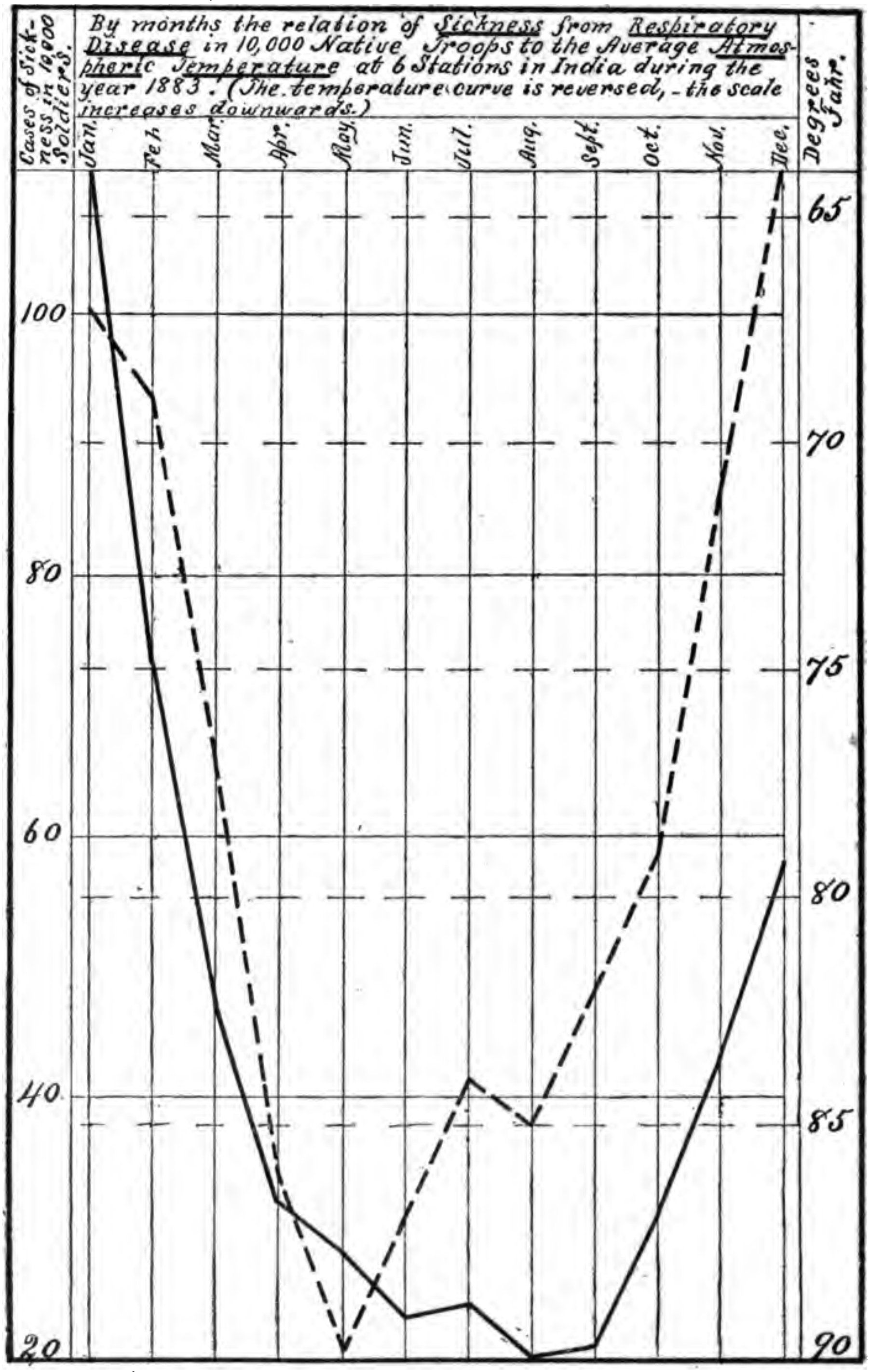
TABLE 21.—*By months, the relation of* SICKNESS *from* RESPIRATORY DISEASE, *in the native troops, to the average Atmospheric Temperature, at six stations in* INDIA *during the year 1883. (Compiled from data in the Twentieth Annual Report of the Sanitary Commissioner with the Government of India,* 1883.)

	Average month.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Respiratory Disease.*	43	111	73	47	32	28	23	24	20	21	31	43	58
Average Temperature.†	78	67	69	77	86	90	87	84	85	82	79	71	64

* Cases of sickness from Respiratory Disease per 10,000 Native troops, months corrected to uniform length.
† At six stations representing approximately the latitude and longitude of the stations of those troops.

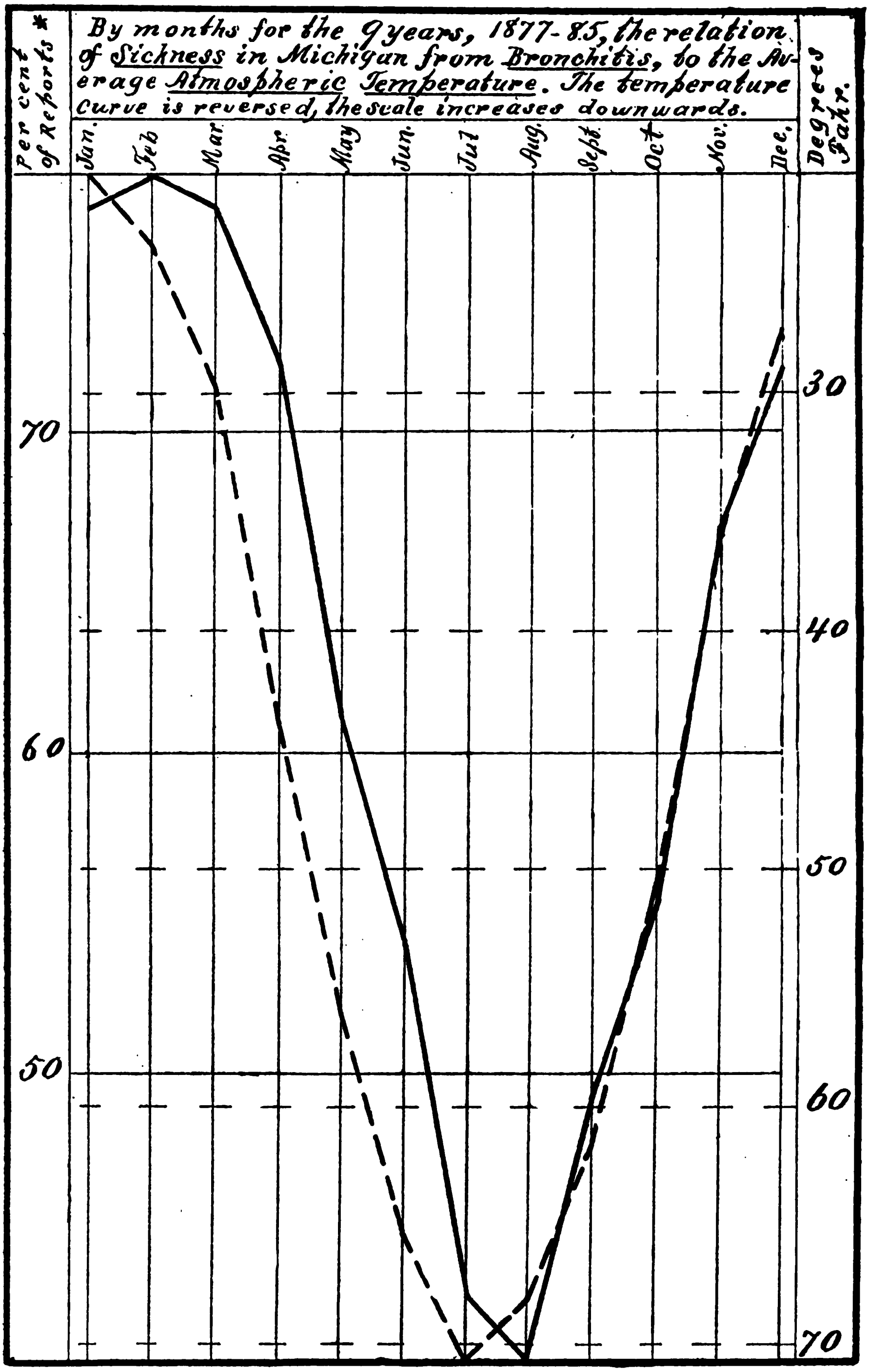
The two lines in Table 21 are graphically represented in Diagram No. 12.

No. 12.—*Temperature, and Sickness from Respiratory Disease in India.*



Sickness from respiratory disease ———, *Average Temperature* — — —.

No. 18.—*Temperature, and Sickness from Bronchitis in Michigan.*



Bronchitis ————. Average Temperature — — —.
* Indicating what per cent of all reports received, stated the presence of Bronchitis then under the observation of the physicians reporting.
Over 35,000 weekly reports of sickness, and about 173,000 observations of the atmospheric temperature are represented in this diagram.

TABLE 22.—*By Months for a Period of nine Years,* 1877–85, *the Relation of* SICKNESS *in Michigan from* BRONCHITIS, *to the Average Atmospheric Temperature.*

	Average.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Sickness from Bronchitis *	62	77	78	77	72	61	54	43	41	49	55	67	72
Av'ge Atmospheric Temperature †	46.25	20.77	28.89	29.76	44.14	56.23	65.30	70.73	68.23	61.73	50.72	36.23	27.28

* Indicating what per cent of all reports received, stated the presence of Bronchitis then under the observation of the physicians reporting.
† Over 35,000 weekly reports of sickness, and about 173,000 observations of atmospheric temperature are represented in this table.

The two lines in Table 22 are graphically represented in Diagram No. 13.

TABLE 23.—*Exhibiting the Average Absolute Humidity by year and months, for the ten years and for each of the ten years* 1877–86. (*These averages are for groups of Stations in Michigan.**)

Years, Etc.	Absolute Humidity.—Grains of Vapor in a Cubic Foot of Air.												
	Average.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. for 10 yrs., 1877-86.	3.44	1.38	1.51	1.81	2.75	3.91	5.27	6.07	5.84	4.98	3.71	2.30	1.73
1877 (9 Stations*)....	3.71	1.37	1.87	1.61	2.83	4.10	5.67	6.33	6.24	5.37	4.08	2.46	2.61
1878 (12 Stations*)...	3.81	1.73	1.83	2.79	3.68	3.88	5.26	7.14	6.37	5.44	3.62	2.47	1.54
1879 (16 Stations*)...	3.43	1.31	1.23	1.93	2.64	3.94	5.09	6.30	5.58	4.40	4.61	2.46	1.70
1880 (14 Stations*)...	3.44	2.13	1.68	1.70	2.69	4.56	5.57	6.09	5.97	4.74	3.18	1.70	1.32
1881 (17 Stations*)...	3.54	1.02	1.38	1.73	2.41	4.66	4.98	6.23	5.97	5.73	3.93	2.36	2.10
1882 (23 Stations*)...	3.48	1.53	2.03	2.06	2.59	3.30	5.20	5.52	6.47	5.03	3.95	2.46	1.59
1883 (18 Stations*)...	3.17	1.11	1.29	1.39	2.55	3.44	5.45	6.02	5.20	4.31	3.22	2.43	1.66
1884 (19 Stations*)...	3.31	1.09	1.37	1.77	2.42	3.78	5.59	5.40	5.52	5.24	3.72	2.11	1.69
1885 (18 Stations*)...	3.14	1.14	0.94	1.25	2.53	3.62	4.90	6.12	5.29	4.56	3.17	2.50	1.72
1886 (16 Stations*)...	3.32	1.32	1.48	1.82	3.11	3.82	4.98	5.59	5.75	4.94	3.64	2.02	1.36

* Thornville, Detroit 1877–86; Kalamazoo 1877–83 and 1886; Mendon 1877–82; Battle Creek 1877–9, 1882, 1885; Otisville 1878–80 and 1882; Marquette 1879–84 and 1886; Alpena, Grand Haven, Port Huron, Lansing 1879–86; Agricultural College 1877–8 and 1881–6; Niles 1878–9 and 1881; Nirvana 1878–9 and first 4 months of 1880; Reed City last 8 months of 1880 and 1881-5; Benton Harbor, Coldwater 1877–8; Escanaba 1880–6; Washington 1880–3; Petoskey 1879; Winfield 1881, 1883; Ann Arbor 1881–6; Woodmere Cemetery 1877–9; Traverse City, Marshall 1882–6; Harrisville 1882, 1885–6; Hastings, Parkville 1882; Manistique 1884–5; Mackinaw City 1884–6; Ionia 1884; Swartz Creek 1884–5; Pentwater 1886; Tecumseh 1878–85; Hillsdale 1882–4.

The evidence shown in the line in this table "Av. for 10 years" is graphically represented in Diagram No. 14, printed further on in this article.

For most of the tables and diagrams which I present relative to ***sickness*** from pneumonia in Michigan, the facts used are those stating for each week whether pneumonia was or was not present (not prevalent, but present), under the observation of each physician who reported. The tables and diagrams state the per cent which the reports stating the presence of pneumonia are of all reports received. It will be seen that this gives for each month the comparative "area of prevalence,"—the extent of the distribution of pneumonia.

Many of the weekly reports of sickness also stated the relative prevalence of pneumonia where present, compared with other diseases. It could not be expected that the evidence on this point would be as exact as is the question of fact as to the presence of pneumonia, because in the "order of prevalence" method there is a comparison of one fact with many others; yet it was hoped that the evidence on one point might supplement the other; and if pneumonia was not dependent upon a general cause acting similarly over wide extents of country the comparative "area of prevalence" of pneumonia in each month would not be sufficient data from which to learn the mode of its causation; if it was generally due to a local cause it might be important to have evidence of the extent of its prevalence wherever the disease occurred. The curves representing the "per cent of reports showing presence of pneumonia" in the several months proved so satisfactory, however, that, for this paper, not much attention has been given to the extent of prevalence of the disease in localities where it occurred. But in order to see how far this last-mentioned evidence coincides with, and how it differs from, the main evidence used, a diagram has been made and studied, but is not printed herewith, exhibiting a curve representing by months the average temperature and the average "order of prevalence" of pneumonia in localities where it was present compared with other diseases. The table on which the diagram was based is printed herewith. It is Table 24. Of course, if the sickness from other diseases is much greater or less in any one month than the average for the year, the standard by which the pneumonia is measured is changed, and if we were to rely upon that line of evidence it would then become necessary to know the relative amount of sickness from all causes in each month in order to see the bearing of the evidence as to comparative prevalence of pneumonia. As a matter of fact, the total sickness does vary slightly by months, as is shown by Table 25, which shows by months for a period of eight years, 1877–1884, the average sickness from all the important diseases. But the variation from the average is so slight in any given month that a fairly good standard of measurement for any single disease is supplied (Table 24); thus the "order of prevalence" of pneumonia in localities where present, as shown in Table 24, is one useful method of studying the subject, although not so accurate as the method by means of "per cent of reports" shown in Diagram No. 1, and the other diagrams and tables relative to sickness in Michigan.

By the line "Average 8 years, 1877–84," in Table 24, it may be seen that pneumonia was most prevalent in February, and least prevalent in August.

TABLE 24.—*Exhibiting* SICKNESS *from* PNEUMONIA, 1877-84. *By Year and Months for each of the eight Years, 1877-84, stating the Average Order of Prevalence of* PNEUMONIA *where present.* (*In this table the small numbers indicate the greatest prevalence, and large numbers the least prevalence of Pneumonia.**)

Periods of Time.	Annual Av.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
		Months.—Average Order of Prevalence.											
Av. 8 years, 1877-84..	4.8	4.1	4.0	4.1	4.2	4.8	5.1	6.0	7.0	6.4	5.8	5.2	4.5
1877..................	4.0	3.0	3.0	3.0	3.0	4.0	4.0	6.0	7.0	7.0	5.0	5.0	4.0
1878..................	4.8	4.1	4.2	3.8	4.2	4.7	5.0	6.0	7.2	6.8	6.3	5.1	4.8
1879..................	5.2	4.7	4.3	4.4	4.5	5.4	6.1	6.3	8.1	6.3	6.3	5.2	4.9
1880..................	5.1	4.4	4.1	4.0	4.5	5.3	5.8	6.3	7.3	6.1	6.5	5.8	5.0
1881..................	5.4	4.2	4.6	4.8	5.0	5.1	5.5	7.7	9.4	7.8	7.3	5.8	4.4
1882..................	4.4	4.1	3.7	3.9	4.2	4.6	4.3	5.5	5.6	5.5	5.2	4.7	4.3
1883..................	4.7	4.5	4.5	4.5	4.7	4.3	5.2	5.2	5.4	4.8	4.8	4.7	4.2
1884..................	4.5	3.8	3.8	4.2	3.7	4.6	5.1	4.9	6.2	6.5	5.3	5.2	4.7

* The "order of prevalence" of a given disease depends on the number of other diseases observed and on the comparative number of cases of that disease.
The *average* order of prevalence of any single disease for a month or a year is found by dividing the sum of the orders of prevalence reported by all who saw the disease by the number of men reporting the disease present. See also foot note ‡ under Table 27, page 282.

TABLE 25.—SICKNESS FROM AVERAGE DISEASE,* 1877-84.—*By Year and Months for each of the Eight Years 1877-84, Stating on an Average for such of the 27 diseases tabulated as were reported present, what per cent of the Weekly Reports received stated presence of the Diseases.*

Years, etc.	Annual Av.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 8 years 1877-84..	31	31	31	31	31	29	28	30	33	34	32	31	30
1877..................	28	27	28	26	24	24	23	26	29	31	30	30	30
1878..................	30	30	30	31	29	28	26	28	32	35	34	30	32
1879..................	33	35	36	36	35	30	30	32	37	36	34	34	33
1880..................	32	32	32	33	31	30	31	34	36	35	32	30	31
1881..................	33	34	34	32	35	31	30	34	37	36	35	32	31
1882..................	30	31	30	30	30	29	28	28	30	34	32	31	29
1883..................	30	30	31	33	33	31	29	29	32	32	29	29	28
1884..................	29	29	29	30	28	28	29	31	34	34	33	30	20

*"Average Disease" is an average of the tabulated diseases reported present on all the card reports received and compiled. It is probably equivalent to the actual sickness from all the diseases printed on the report cards, and probably represents very nearly the average sickness from all the diseases in the State.

REMARKS RELATIVE TO TABLES 26 AND 27.

For many years it has been my practice to study the relations which sickness or deaths from pneumonia bear to the principal meteorological conditions, by means of a table similar to Table 26, page 281, by noting whether each condition was above or below its average for the year, in months when more, and in months when less pneumonia than the average for the year was reported. The months are arranged in order according to the amount of pneumonia reported, those in which most pneumonia was reported being placed first in the column, and those in which more pneumonia than the average was reported being placed above the average line, the others below that line. The conditions for each month are printed, in the proper colums in the line for the month. The statements being thus arranged, it is easy to see whether the temperature, the velocity of the wind, or any other condition represented, was above its average for the year in months when more than the average amount of pneumonia was reported, and in months when less pneumonia was reported. That the comparisons may the more readily be held in mind, propositions have been made concerning the relations of pneumonia to meteorological conditions, grouping the conditions into two classes. The letters *a* and *b*, in the table, mark exceptions to these propositions, and the letter *c* indicates that there was no exception. It is not supposed that the propositions are in every case true; but they serve to bring out the evidence of the table on the subject in question. This evidence is to be had by noting the number and force of the exceptions to the propositions, and also whether the exception is explained by facts shown in other columns.

By this method of study, it was found that pneumonia bore very close relations to certain meteorological conditions, and that the exceptions to the propositions were frequently in months near the average line.

By the use of diagrams it was discovered that the sickness from pneumonia followed about one month later than the meteorological conditions which seemed to have causal relation to pneumonia. Probably this has appeared so because the unit of measurement of time in the diagrams is one month, and the sickness is reported so long as it lasts, which is probably, on the average, more than half a month, but not necessarily or probably the full month.

Since it has been learned that pneumonia has close relations to the meteorological conditions in the month preceding that in which much of the sickness is observed, it seems important to modify the plan adopted in Table 26 which deals with the conditions in the same month as the sickness, and to study the subject as it is done in Table 27, page 282, which is on a similar plan, except that the meteorological conditions are those in the month preceding the one for which the sickness from pneumonia is stated.

By Table 27, for the 8 years 1877–84 it may be seen that there is no exception to the proposition relating to the average temperature and the average absolute humidity of the atmosphere—the evidence is as strong as it can be; and close study of the table will also reveal a quantitative relation of these conditions to the sickness from pneumonia. The quantitative relation, however, is most strongly shown by the diagrams, and especially by Diagram No. 1, page 252.

TABLE 26.—*Exhibiting what per cent of weekly reports stated the presence of Pneumonia in Michigan by months in the eight years* 1877–1884, *together with the* COINCIDENT *meteorological conditions,—for the same period of time, except as stated in foot-note*††.

	Pneumonia.			Temperature, Fahr.		Humidity of Air.§ Av. of 3 Daily Observations.		Vapor Inhaled and Exhaled, from Air Passages, by one Person in 24 Hours. Troy Ounces.			Ozone—Relative Scale of 10°.			Atmospheric Pressure. Inches Reduced to 32° F.		
	Months in order of Greatest Per Cent of Weekly Reports Stating Presence of.	Per Cent of Weekly Reports Stating Presence of.†	Av. Order of Prevalence where Present.†‡.	Av. Daily Range, by Registering Thermometers.	Average of 3 Daily Observations.	Relative Per Cent of Saturation.	Absolute—Grains of Vapor in a Cubic Foot of Air.	Inhaled.||	Exhaled in Excess of that Inhaled.¶	Average Per Cent of Cloudiness.	Daily Observation, 7 A. M. to 2 P. M.	Night Observation, 9 P. M. to 7 A. M.	Average Velocity of Wind, Miles per Hour, by Anemometer.	Range. Monthly, and for Year.	Range. Average Daily, by 3 Daily Observations.**	Average Pressure.
More than Av. Per Cent of Pneumonia.	Feb.	66	4.0	*a*17.58	25.60	79	1.59	.99	10.69	62	3.57	4.30	10.6	1.181	.300	29.198
	Mar.	62	4.1	*a*17.67	31.04	76	1.87	1.17	10.51	61	3.53	3.73	10.3	1.191	.308	*a*29.140
	Jan.	62	4.1	*a*16.67	21.43	81	1.41	.88	10.80	68	3.44	3.98	11.2	1.189	.327	29.206
	April	56	4.2	13.49	44.48	*a*68	2.73	1.71	9.97	*a*51	3.25	*a*3.09	10.4	1.045	*a*.192	*a*29.102
	Dec.	48	4.5	*a*13.31	27.25	82	1.78	1.11	10.57	77	3.16	*a*3.07	10.6	1.064	.257	29.177
	May	42	4.8	20.85	*b*56.60	*a*67	*b*3.96	2.48	9.20	*a*48	3.12	3.28	10.1	*a*.789	*a*.178	*a*29.128
Average.........		39	4.8	18.17	46.74	75	3.49	2.18	9.50	56	*c*3.09	3.11	9.6	.938	.218	29.154
Less than Av. Per Cent of Pneumonia.	Nov.	36	5.2	15.15	*b*35.99	*a*78	*b*2.31	1.44	10.24	*a*67	2.99	2.80	*a*10.5	*a*1.002	*a*.243	*a*29.187
	June	27	5.1	*a*20.04	65.54	72	5.35	3.34	8.34	48	2.92	2.70	8.1	.752	.145	29.090
	Oct.	23	5.8	17.56	51.34	62	3.79	2.37	9.31	*a*57	2.71	2.74	9.5	*a*.952	.210	*a*29.193
	Sept.	18	6.4	*a*19.77	62.05	*a*75	5.03	3.14	8.54	45	2.71	2.42	8.3	.884	.150	*a*29.181
	July	17	6.0	*a*19.83	70.68	72	6.13	3.83	7.85	43	2.74	2.57	8.4	.587	.127	29.106
	Aug.	14	7.0	*a*20.09	68.85	73	5.92	3 70	7.98	47	2.83	2.62	7.6	.611	.126	29.152

††Daily Range of Temperature for six years, Relative Humidity for seven years, Velocity of Wind and Daily and Monthly Range of Barometer for three years.

The numbers in the first figure column in Table 26 representing "Per Cent of Weekly Reports," etc., are graphically shown in Diagrams Nos. 1, 4, and 8; and the numbers in the fourth figure column, representing temperature, are graphically shown in Diagrams Nos. 1 and 3.

FOOT-NOTES TO TABLE 26 (Meteorological Conditions Coincident with Pneumonia).

a An exception to the proposition that in months when *more* than the average per cent of weekly reports stated the presence of Pneumonia the meteorological condition named at the head of the column was *greater* than the average for the eight years under consideration; and in months when *less* than the average per cent of weekly reports stated the presence of Pneumonia the meteorological condition named at the head of the column was *less* than the average.

b An exception that in months when *more* than the average per cent of weekly reports stated the presence of Pneumonia the average daily temperature and the absolute humidity were *less* than the average for the eight years; and in months when *less* than the average per cent of weekly reports stated the presence of Pneumonia, these conditions were *greater* than the average for the eight years.

c As regards Day ozone, there are no exceptions to propositions stated below.

†, ‡, §, ||, ¶, **, See foot-notes with these marks in Table 27.

PROPOSITION 1.—That in months when *more* than the average per cent of weekly reports stated the presence of Pneumonia, the average daily range of temperature, the relative humidity of the atmosphere, the average per cent of cloudiness, the ozone, the average velocity of the wind, the monthly and the average daily range of the barometer, and the average daily pressure of the atmosphere were *greater* than the average for the year; and in months when *less* than the average per

cent of weekly reports stated the presence of Pneumonia these conditions were *less* than the average for the year. In Table 26 the letter *a* marks exceptions to this proposition.

PROPOSITION 2.—That in months when *more* than the average per cent of weekly reports stated the presence of Pneumonia the average daily temperature and the absolute humidity were *less* than the average for the eight years; and in months when *less* than the average per cent of reports stated the presence of Pneumonia these conditions were *greater* than the average for the eight years.

In Table 26 the letter *b* marks exceptions to this proposition.

In Table 26 there are eight exceptions to proposition 1 in average daily range of temperature, four exceptions in relative humidity, four exceptions in average per cent of cloudiness, two exceptions in night ozone, one exception in average velocity of wind, three exceptions in both monthly and average daily range of barometer, and six exceptions in average atmospheric pressure,—that is to say proposition 1 holds good as regards average daily range of temperature, in only four of the twelve months, as regards relative humidity and average per cent of cloudiness in eight months, as regards day ozone, in all the twelve months, as regards night ozone, in ten months, as regards velocity of wind, in eleven months, as regards monthly and average daily range of barometer, in nine months, and as regards average atmospheric pressure, in six months or just one-half the whole number.

In Table 26 there are two exceptions to proposition 2 in both average daily temperature and absolute humidity—or in other words proposition 2 holds good as regards both average daily temperature and absolute humidity in ten months out of the twelve.

TABLE 27.—*Exhibiting per cent of weekly reports that stated the presence of Pneumonia in Michigan by months in the eight years* 1877-1884, *together with the meteorological conditions of the* PRECEDING MONTH *in each case for the same period of time, except as stated in foot-note.*††

	Pneumonia.			Temperature, Fahr.		Humidity of Air. § Av. of 3 Daily Observations.		Vapor Inhaled and Exhaled, from Air-Passages, by one Person in 24 Hours. Troy Ounces.			Ozone—Relative Scale of 10°.			Atmospheric Pressure. Inches Reduced to 32° F.		
														Range.		
	Months in order of Greatest Per Cent of Weekly Reports Stating Presence of.	Per Cent of Weekly Reports Stating Presence of.†	Av. Order of Prevalence where Present.†,‡	Av. Daily Range by Registering Thermometer.	Average of 3 Daily Observations.	Relative Per Cent of Saturation.	Absolute—Grains of Vapor in a Cubic Foot of Air.	Inhaled.‖	Exhaled in Excess of that Inhaled.¶	Average Per Cent of Cloudiness.	Day Observation, 7 A. M. to 2 P. M.	Night Observation, 9 P. M. to 7 A. M.	Average Velocity of Wind, Miles per Hour, by Anemometer.	Monthly, and for Year.	Average Daily, by 3 Daily Observations.**	Average Pressure.
More than Av. Per Cent of Pneumonia.	Feb.	66	4.0	*a*16.67	21.43	81	1.41	.88	10.80	68	3.44	3.98	11.2	1.189	.327	29.206
	Mar.	62	4.1	*a*17.58	25.60	79	1.59	.99	10.69	62	3.57	4.30	10.6	1.181	.300	29.198
	Jan.	62	4.1	*a*13.31	27.25	82	1.78	1.11	10.57	77	3.16	*a* 3.07	10.6	1.064	.257	29.177
	April	56	4.2	*a*17.67	31.04	76	1.87	1.17	10.51	61	3.53	3.73	10.3	1.191	.308	*a* 29.140
	Dec.	48	4.5	*a*15.15	35.99	78	2.31	1.44	10.24	67	*a* 2.99	*a* 2.80	10.5	1.002	.243	29.187
	May	42	4.8	19.49	44.48	*a*68	2.73	1.71	9.97	*a* 51	3.25	*a* 3.09	10.4	1.045	*a*.192	*a* 29.102
Average.		39	4.8	18.17	*c*46.76	75	*c*3.49	2.18	9.50	56	3.09	3.11	9.6	.938	.218	29.154
Less than Av. Per Cent of Pneumonia.	Nov.	36	5.2	17.56	51.34	62	3.79	2.37	9.31	*a* 57	2.71	2.74	9.5	*a* .952	.210	*a*29.193
	June	27	5.1	*a*20.85	56.60	67	3.96	2.48	9.20	48	*a* 3.12	*a* 3.28	*a* 10.1	.789	.178	29.128
	Oct.	23	5.8	*a*19.77	62.05	*a* 75	5.03	3.14	8.54	45	2.71	2.42	6.3	.884	.150	*a* 29.181
	Sept.	18	6.4	*a*20.09	68.85	73	5.92	3.70	7.98	47	2.83	2.62	7.6	.611	.126	29.152
	July	17	6.0	*a*20.04	65.54	72	5.35	3.34	8.34	48	2.92	2.70	8.1	.752	.145	29.090
	Aug.	14	7.0	*a*19.83	70.68	72	6.13	3.83	7.85	43	2.74	2.57	8.4	.587	.127	29.106

†† Daily Range of Temperature for six years, Relative Humidity for seven years, Velocity of Wind and Daily and Monthly Range of Barometer for three years.

The numbers in the first figure-column representing "Per Cent of Weekly Reports," etc., are graphically shown in Diagrams Nos. 1, 4 and 8; and the figures in the fourth figure-column, in Table 27, representing temperature, are shown in Diagrams Nos. 1 and 3.

FOOT NOTES TO TABLE 27.—(Meteorological Conditions Preceding Pneumonia.)

a An exception to the proposition that in months next preceding those in which *more* than the average per cent of weekly reports stated the presence of pneumonia the meteorological condition named at the head of the column was *greater* than the average for the eight years under consideration; and in months next preceding those in which *less* than the average per cent of weekly reports stated the presence of pneumonia, the same conditions were *less* than the average.

b An exception to the proposition that in months next preceding those in which *more* than the average per cent of weekly reports stated the presence of pneumonia the meteorological condition named at the head of the column was *less* than the average for the year; and in months next preceding those in which *less* than the average per cent of reports stated the presence of pneumonia the same condition was *greater* than the average for the year.

c As regards average daily temperature and absolute humidity, there is no exception to proposition 2, stated further on.

† When the per cent of reports stating the presence of pneumonia is the same for two months, the order of these months in the first column of this exhibit has been determined by reference to the "order of prevalence where present," of pneumonia in the same months. (See foot note ‡.) Where per cent of reports and "order of prevalence" are both the same for two months, the order of the months in the first column has been determined by reference to fractional per cents.

‡ The disease of which there is the greatest number of cases under the observation of the reporter in any locality is marked 1 in order of prevalence, the disease having the next greatest number of cases 2, and so on; therefore the smaller the number in this column the greater the prevalence of the disease in the localities where it occurred, as compared with other diseases; and *vice versa*, large numbers indicate a less prevalence.

§ Calculated from readings of dry bulb and wet bulb thermometers.

‖ Calculated for eighteen respirations per minute of twenty cubic inches of air each.

¶ Assuming the air exhaled to be saturated with vapor at the temperature of 98° F., in which case each cubic foot of air contains 18.69 grains of vapor, and eighteen respirations per minute of twenty cubic inches of air each, make 11.68 Troy ounces of vapor exhaled daily. No correction has been made for expansion of air after it has been inhaled.

** The daily range from which numbers in this column were computed is the difference between the highest and the lowest of the four observations during the twenty-four hours, namely, at 7 A. M., 2 P. M., 9 P. M. of one day, and 7 A. M. of the following day, or at the U. S. Signal Stations at 7 A. M., 3 P. M., 11 P. M., and 7 A. M., Washington mean time.

PROPOSITION 1.—That in months next preceding those in which *more* than the average per cent of weekly reports stated the presence of pneumonia, the average daily range of temperature, the relative humidity of the atmosphere, the average per cent of cloudiness, the ozone, the average velocity of the wind, the monthly and the average daily range of the barometer, and the average daily pressure of the atmosphere were *greater* than the average for the year; and in months next preceding those in which *less* than the average per cent of the reports stated the presence of pneumonia these conditions were *less* than the average for the year. In Table 27, the letter *a* marks exceptions to this proposition.

PROPOSITION 2.—That in months next preceding those in which *more* than the average per cent of weekly reports stated the presence of pneumonia the average daily temperature and the absolute humidity of the atmosphere were *less* than the average for the year; and in months next preceding those in which *less* than the average per cent of reports stated the presence of pneumonia, these conditions were *greater* than the average for the year.

In Table 27 there are in the twelve months ten exceptions to proposition 1 in average daily range of temperature, two exceptions in relative humidity, two exceptions in average per cent of cloudiness, two exceptions in day ozone, four exceptions in night ozone, one exception in average velocity of wind, one exception in monthly range of barometer, one in average daily range of barometer, and four exceptions in average atmospheric pressure; that is to say proposition 1 holds good concerning daily range of temperature in only two of the twelve months, concerning relative humidity, average per cent of cloudiness, and day ozone, it holds good in ten months, concerning night ozone, in eight months, concerning average velocity of wind, monthly range and average daily range of barometer, in eleven months, and concerning average atmospheric pressure, in eight out of the twelve months.

In Table 27, there is no exception to proposition 2, that is to say, as regards average daily temperature and the absolute humidity of the atmosphere the proposition holds good for every one of the twelve months. By studying Table 26, in which the average monthly meteorological conditions are *coincident* with the months in which the sickness from pneumonia is reported, and comparing it with Table 27, in which the meteorological conditions are given for the month next preceding that in

which the sickness from pneumonia is reported, we find that concerning relative humidity proposition 1 holds good in 8 months in Table 26 and in 10 months in Table 27; that concerning average per cent of cloudiness proposition 1 holds good in 8 months in Table 26, and 10 months in Table 27; that concerning day ozone proposition 1 holds good in the entire 12 months in Table 26 and in 10 months in Table 27; that concerning night ozone proposition 1 holds good in 10 months in Table 26, and in 8 months in Table 27; that concerning average velocity of wind proposition 1 holds good in 11 months in Table 26, and in the same number of months in Table 27; and that concerning both average daily temperature and absolute humidity proposition 2 holds good in 10 months of the 12 in Table 26, and in the entire 12 months in Table 27.

RELATIVE HUMIDITY, AND PNEUMONIA.

It has been stated frequently, especially in England, that there is most mortality from pneumonia when the air is cold and *moist*. For some years I have been accustomed to say that in Michigan there is most sickness (and there are also most deaths) from pneumonia when the air is cold and *dry*. The chief reason for this different statement was my belief that it was the dryness and not the dampness which causes the disease; because whether we shall say dry or moist, as regards most seasons of the year, depends upon whether we speak of the absolute or of the relative humidity of the air.* In cold weather the air, in Michigan at least, is more nearly saturated, that is to say its relative humidity is greater than it is in warm weather, because the capacity of warm air to hold moisture is so great that its point of saturation is not so soon reached; but in cold weather the air is absolutely drier than it is in warm weather, because cold air has so little capacity to hold vapor that moisture is deposited out of the air as fast as its temperature is lowered.

Theoretically, it would appear that great relative humidity may be directly injurious to human tissues in cold weather by reason of the increased abstraction of heat from the body and particularly from the air-passages, because of the much greater specific heat of water than of air,—the body parting with its heat by conduction so much more readily to moist than to relatively dry air. The circulation of the blood through the lungs may be interfered with by such abnormal abstraction of heat while exposed to out-door air, and by the reaction consequent upon a return from such cold moist atmosphere to a heated room. Congestion of the lungs may perhaps be thus induced.

The evidence of the relation of the relative humidity of the atmosphere to pneumonia in Michigan which I present, is as follows: By the tables which I present, but more especially by the diagram (No. 4) of averages for eight

* By the term "Absolute humidity" of the air, we mean the grains of vapor in each cubic foot of air. By "Relative humidity" we mean the per cent of saturation of the air with vapor of water, 100 per cent being entire saturation of the air with vapor. The capacity of air to contain vapor differs with each degree of temperature, therefore, statements of the relative humidity convey no knowledge of the actual amounts of vapor in the air, unless the temperature is also stated.

years it may be seen that in Michigan the relative humidity increases from May to December, and that the sickness from pneumonia increases from August to February; the relative humidity decreases from December to May, and the sickness from February to July. Both the sickness and the deaths (as shown in Diagram No. 5) appear to follow too far behind the changes in the relative humidity to make it probable that relative humidity has much influence in the causation of pneumonia. The curve for cloudiness is something like the curve for relative humidity; and it is not easy to see how cloudiness can have a causative relation to pneumonia. Relative humidity and cloudiness have necessary relations to temperature, and the inference is that the similarity of their curves to that representing pneumonia is mainly because of the causal relation of temperature to the relative humidity, to the cloudiness, and to the pneumonia.

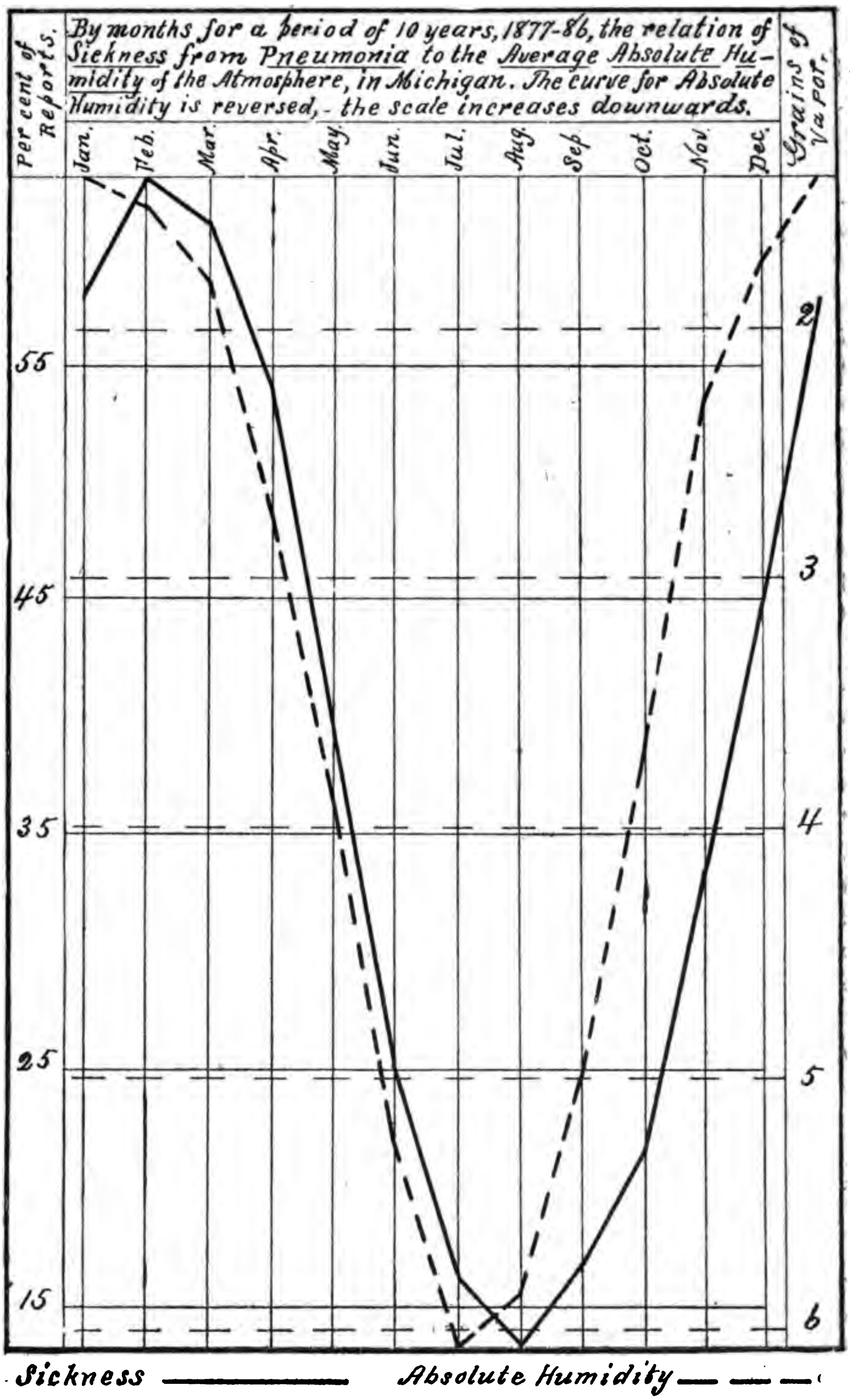
ABSOLUTE HUMIDITY, AND PNEUMONIA.

How much closer relations exist between absolute humidity and pneumonia than between relative humidity and pneumonia can be appreciated by comparing Diagram No. 4, page 258, with Diagram No. 14, page 286.

It should be remembered, however, with reference to both relative and absolute humidity, that our knowledge of the humidity of the atmosphere is not gained by the simple observation of an instrument, as is our knowledge of the temperature, but through laborious computations by means of tables, and employing the results of observations of two instruments—the wet-bulb and dry-bulb thermometers. There are, therefore, more chances for errors, in observations and in computations. Moreover the wet-bulb thermometer is liable to be out of order; and the tables which one scientist has supplied for the interpretation of the observations do not agree with those supplied by another, or even with those by the same author at a later time, indicating that our knowledge of that subject is still only approximate. It is known, however, that the capacity of air to contain moisture varies somewhat regularly with its temperature, and it is reasonable to infer that a curve representing the actual absolute humidity of the atmosphere would not differ much from a curve representing the temperature of the atmosphere.

By comparing the curve representing absolute humidity, in Diagram No. 14, with that representing temperature, in Diagram No. 1, the similarities and slight differences in the two curves may be seen; and in these diagrams (1 and 14) it may be seen that the curve for sickness from pneumonia follows the curve for temperature and that for absolute humidity so closely as to indicate a causal relation.

NO. 14.—*Absolute Atmospheric Humidity, and Sickness from Pneumonia.*



just stated, which I have employed for several years and which indicates the average amount of vapor of water exhaled by the lungs as 11.68 Troy ounces daily. This amount is 4 to 6 ounces less than the quantity obtained by the experiments of Valentin above referred to.

The absolute grains of vapor in the atmosphere at any given time is ascertained by means of the wet-bulb and dry-bulb thermometers, and by the use of tables, as mentioned on page 285, 7. Assuming that there are 300 cubic feet of air breathed in a day, and knowing the absolute grains of vapor of water in a cubic foot of air at the temperature which prevailed on that day, the product of these two gives the number of grains of vapor breathed in a day, which divided by the number of grains in an ounce gives the number of ounces of vapor breathed in a day, which subtracted from the number of ounces exhaled gives the excess of moisture exhaled over that inhaled.

In my tables (26 and 27), however, no correction has been made for expansion of the air inhaled. Wm. Allen Miller, M. D., LL. D.,* states concerning the expansion of gases: "Experiment has shown that for every degree of heat upon Fahrenheit's scale, an amount of expansion takes place equal to $\frac{1}{491}$ of the bulk that the gas occupied at 32° F." This is nearly the same as the coefficient for the expansion of air as stated by Regnault,† which is given as 0.0020361 of its bulk for one degree Fahrenheit. Assuming this coefficient to be correct, the three hundred cubic feet of air inhaled daily during the month of January (the coldest month during the period under consideration) would expand, because of the increased temperature of the exhaled breath, 46.7 cubic feet or about one-sixth of its bulk, while the 300 cubic feet of air inhaled daily during the month of July (the warmest month of the period under consideration) would expand 16.7 cubic feet or about one-eighteenth of its bulk; the average expansion of 300 cubic feet of air inhaled daily for the eight-year period under consideration would be 31.1 cubic feet or about one-tenth of its bulk. This more than counterbalances the quantity of air said to be lost by inhalation,—amounting to only one-seventieth to one-fiftieth of its bulk of air near the same temperature as when exhaled. The quantity of vapor exhaled, as stated in my tables, should therefore be increased, because of the expansion of air inhaled, by one-tenth minus one-fiftieth, or eight one-hundredths. Thus it would be 12.61 ounces Troy instead of 11.68; and this increased quantity more nearly corresponds with that experimentally estimated by Valentin.

All physiologists agree that the quantity of vapor exhaled depends greatly upon circumstances, such as the rapidity of respiration, quantity of fluid in the body, quantity of lung-surface used, etc., etc.; and it is apparent that the quantity of vapor will depend upon the quantity of air and the humidity of the air inhaled. This last-mentioned influence upon the elimination of water is one upon which I wish to dwell. In the table (No. 26) exhibiting the relations which the sickness from pneumonia bore to the several meteorological conditions in Michigan by months in the eight years 1877–1884, which I here present, it may be seen that, computed by the plan I have mentioned, the average quantity of vapor exhaled daily in the eight years, in excess of the vapor inhaled, was 9.5 Troy ounces; that is to say—assuming that the air exhaled was saturated with vapor of water at the uniform temperature of

* Elements of Chemistry: Theoretical and Practical. New York, 1874. Part I., p. 200.
† Tables, Meteorological and Physical, prepared for the Smithsonian Inst. by Arnold Guyot, Ph. D., LL. D., page B. 92.

ration at the temperature of 32° F. shows the presence of one grain of vapor of water in each cubic foot of air, while at 70° F. it shows the presence of 4 grains, etc., these being 50 per cent of the quantities mentioned above as in air completely saturated with vapor of water.

Starting with the fact that the normal temperature of the human body is 98.5°F. and the fact that the air exhaled has been in contact with the air-passages and is mixed with air from the air-cells in the lungs, we may safely assume that, whatever its temperature when inhaled, the temperature of the air when exhaled will not be much different from the temperature of the body, and that it will probably not vary much at different seasons of the year.

Direct experiments were made by Dr. Grehant.* "He found that with an external temperature of 72°, respiring 17 times per minute, the air taken in by the nose and expired by the mouth, through an apparatus containing a thermometer carefully protected from external influences, marked a temperature of 95.4°"* A late work on physiology states that "The air which is exhaled from the lungs leaves the body at about the temperature of the blood, and is always saturated with moisture."†

The air exhaled has been in contact with moist surfaces throughout its passage into and out from the lungs; it is therefore, probably, as a rule, nearly saturated with vapor of water. The experiments of Valentin, however, seem to indicate that the expired air is not always completely saturated, because it is stated that he "found that the pulmonary transpiration was more than doubled in man immediately after drinking a large quantity of water."‡

For purposes of study I have found it convenient to assume that the air exhaled from the human lungs has a constant temperature of 98° F.‖ Even if the temperature of the air exhaled is slightly more or less than 98°, that will not materially injure the evidence which I have to present. The same remark applies to the degree of saturation of the air with vapor of water.

Assuming that the air exhaled has uniformly a temperature of 98° F., and that it is saturated with vapor of water, each cubic foot of air exhaled contains, according to Guyot's tables, 18.69 grains of water; assuming 18 respirations per minute, of 20 cubic inches of air each, there will be exhaled daily from the lungs and air-passages 11.68 Troy ounces of water in the form of vapor. According to Pettenkofer and Voit, the quantity thus exhaled is about eleven ounces. But this is not as much as is stated by some physiologists,—thus on page 289 Dalton's Physiology (6 Edition, 1875) Prof. Dalton says: "According to the researches of Valentin, the average quantity of water exhaled from the lungs is about 500 grammes per day," which would be about sixteen Troy ounces. In referring to Valentin's experiments, Prof. Flint, (page 153 of his Text Book, 1876) says: "The mean of his observations gave a daily exhalation of 8,333 grains, or about one and one-fifths lb. av." However, it is convenient to have a standard arrived at by the same means as those with which we must deal in studying the influence of meteorological conditions; and in this paper I shall continue to employ the method

---

* Grehant, Recherches, etc., Physiology of Man, Flint, Vol. I, Blood, etc., p. 423.

† Kirkes' Handbook of Physiology, by W. Morrant Baker, F. R. C. S., and Vincent Dormer Harris, M. D., Eleventh Edition, Vol. I, Wm. Wood & Co., New York, 1885, p. 315.

‡ Flint's Text Book on Physiology, 1876, p. 154.

‖ By wrapping a thermometer in perfectly dry cotton, silk or woolen cloth and breathing upon it, it is easy to make it indicate a temperature of 100°F.; and even a temperature of 110° or 115° may be reached. It is probable, however, that this higher temperature than 98.5° is due to an accumulation of heat in excess of the temperature of the incident air; this accumulation occurring because of the condensation of vapor of water. (Nature, London, Eng., Vol. XXII, 1880, pages 241, 534, 584, 607 and Vol. XXIII, pp. 10, 55, 76, 217, 244.)

just stated, which I have employed for several years and which indicates the average amount of vapor of water exhaled by the lungs as 11.68 Troy ounces daily. This amount is 4 to 6 ounces less than the quantity obtained by the experiments of Valentin above referred to.

The absolute grains of vapor in the atmosphere at any given time is ascertained by means of the wet-bulb and dry-bulb thermometers, and by the use of tables, as mentioned on page 285, 7. Assuming that there are 300 cubic feet of air breathed in a day, and knowing the absolute grains of vapor of water in a cubic foot of air at the temperature which prevailed on that day, the product of these two gives the number of grains of vapor breathed in a day, which divided by the number of grains in an ounce gives the number of ounces of vapor breathed in a day, which subtracted from the number of ounces exhaled gives the excess of moisture exhaled over that inhaled.

In my tables (26 and 27), however, no correction has been made for expansion of the air inhaled. Wm. Allen Miller, M. D., LL. D.,* states concerning the expansion of gases: "Experiment has shown that for every degree of heat upon Fahrenheit's scale, an amount of expansion takes place equal to $\frac{1}{491}$ of the bulk that the gas occupied at 32° F." This is nearly the same as the coefficient for the expansion of air as stated by Regnault,† which is given as 0.0020361 of its bulk for one degree Fahrenheit. Assuming this coefficient to be correct, the three hundred cubic feet of air inhaled daily during the month of January (the coldest month during the period under consideration) would expand, because of the increased temperature of the exhaled breath, 46.7 cubic feet or about one-sixth of its bulk, while the 300 cubic feet of air inhaled daily during the month of July (the warmest month of the period under consideration) would expand 16.7 cubic feet or about one-eighteenth of its bulk; the average expansion of 300 cubic feet of air inhaled daily for the eight-year period under consideration would be 31.1 cubic feet or about one-tenth of its bulk. This more than counterbalances the quantity of air said to be lost by inhalation,—amounting to only one-seventieth to one-fiftieth of its bulk of air near the same temperature as when exhaled. The quantity of vapor exhaled, as stated in my tables, should therefore be increased, because of the expansion of air inhaled, by one-tenth minus one-fiftieth, or eight one-hundredths. Thus it would be 12.61 ounces Troy instead of 11.68; and this increased quantity more nearly corresponds with that experimentally estimated by Valentin.

All physiologists agree that the quantity of vapor exhaled depends greatly upon circumstances, such as the rapidity of respiration, quantity of fluid in the body, quantity of lung-surface used, etc., etc.; and it is apparent that the quantity of vapor will depend upon the quantity of air and the humidity of the air inhaled. This last-mentioned influence upon the elimination of water is one upon which I wish to dwell. In the table (No. 26) exhibiting the relations which the sickness from pneumonia bore to the several meteorological conditions in Michigan by months in the eight years 1877–1884, which I here present, it may be seen that, computed by the plan I have mentioned, the average quantity of vapor exhaled daily in the eight years, in excess of the vapor inhaled, was 9.5 Troy ounces; that is to say—assuming that the air exhaled was saturated with vapor of water at the uniform temperature of

*Elements of Chemistry: Theoretical and Practical. New York, 1874. Part I., p. 200.
†Tables, Meteorological and Physical, prepared for the Smithsonian Inst. by Arnold Guyot, Ph. D., LL. D., page B. 92.

98° F. and 18 respirations per minute of 20 cubic inches of air each, 11.68 Troy ounces of vapor will be exhaled daily; and if the average quantity of vapor inhaled be subtracted therefrom it will show the quantity of water exhaled in excess of that inhaled. The quantity of vapor inhaled is found by means of that column in the table next preceding the column which states the quantities of vapor inhaled,—the one showing the absolute humidity of the air in grains of vapor in each cubic foot; the eighteen respirations per minute give 25,920 respirations per day, of 20 cubic inches of air each equal 300 cubic feet of air; each cubic foot of which contained on an average, in the eight years, 349 grains of vapor, which made 2.18 Troy ounces of vapor of water inhaled, which subtracted from the 11.68 ounces exhaled, shows 9.5 ounces exhaled in excess of that inhaled.

Turning again to this same table (No. 26) it may be seen that there was a considerable difference in the several months of the eight years—ranging from an average of only about 8 (7.85) ounces daily in July to an average of about 11 (10.80) ounces daily in January,—a difference of about three ounces of water more, daily, taken from the blood through the lung-tissue in January than in July.* This three additional ounces of water is equal to one-fourth of the total average quantity exhaled. In passing out from the blood into the air-cells in the lungs and into the bronchial tubes, it took with it certain constituents of the blood; what were they? The salts of the blood will usually most readily pass out; but we know that in pneumonia something more than the salts pass out. Let us first consider some facts which seem to have been established relative to one important class of salts of the blood,—namely, the chlorides.

OSMOSIS IN THE LUNGS—IT IS MODIFIED BY RESPIRATION.

The average quantity of chloride of sodium, potassium, and magnesium in the blood has been stated to be 3.5 parts per 1,000.† The composition of nasal mucus has been ascertained by analyses and is stated in text-books. The quantity of chlorides of sodium and potassium in nasal mucus is stated by Prof. Flint (analysis by Robin) to be 5.09 to 5.60 parts per 1,000.‡ Speaking of the bronchial and pulmonary mucus he says: "This variety of mucus is alkaline and is quite similar to nasal mucus in its appearance and general characters." The above-mentioned facts and analyses § prove that the fluid which passes from the blood-vessels to the air-passages and air-cells is not pure water, but contains also varying quantities of the salts of the blood. This is also in accordance with the laws of osmosis, stated in our text-books on physiology and on chemical physics, such as that when two fluids are separated by a membrane for which they both have an affinity, currents will occur in both directions, though not with equal force, and the constitution of each fluid will tend to approach that of the other.

But in the air-passages the conditions are not the same as in the case of two fluids similarly acted upon, because on one side of the pulmonary membrane the moisture is constantly being evaporated, thus tending toward the

* It must be understood that these are averages for *months*, and that all excessive *daily* fluctuations in quantity which occurred are here reduced so that they do not appear; we know, however, that such daily fluctuations occur; and it is reasonable to suppose because of the evidence in this article, that those in one direction tend toward the causation of pneumonia.
† Page 132, Vol. on Blood, etc., Flint's Physiology.
‡ Page 356, Flint's Physiology, Single Vol.
§ See also the Medical Times, London, 1844-5, page 200, for analysis of mucus from nostrils and trachea, by Berzelius.

concentration of the non-volatile saline constituents on that side of the membrane. This probably explains the reason why, as shown above, normal nasal mucus contains more than fifty per cent more of the chlorides than does the blood. Normally, therefore, the evaporation is sufficiently rapid so that the tendency of the fluids on the two sides of the pulmonary membrane to approximate to each other in condition is overcome, and this normal difference will naturally be increased whenever the evaporation is excessive.

There is reason to think that as the fluid is normally transuded into the air-passages it does not contain 5. or 5.6 parts of chlorides per 1,000, because analysis shows that perspiration, collected as it transudes, contains only about 2.47 parts per 1,000.* But if perspiration is subjected to rapid currents of air as is the fluid in the nose and air-passages, it may become even a saturated solution, as is shown by the fact that crystals of sodium chloride may sometimes be seen on the sleeves of workmen, where the perspiration has had opportunity to evaporate.

"It is to be understood that the presence of albumen in mucus is always a proof of the latter being impure, and of having been secreted under circumstances of local inflammation or irritation."† Dr. Wright says: "I have never myself met with uncombined soda in a specimen of *pure mucus*; but I have occasionally found traces of it in those varieties of mucus which have contained *free albumen*."† "The mucus of the nose, obtained during an active catarrh, when the natural secretion was little altered in appearance, gave the following results:

Water		942.4
Mucus		45.5
Albumen with soda		3.2
Muriates.... Lactates.... Phosphates.	Potash.. Soda....	7.1
Loss		1.8
		1,000.0

Dr. Wright states the results of three analyses of pus, from various sources, and says: "From various and multiplied observations, I am satisfied that no specific composition can be assigned to pus. Without deviating from a natural and healthy standard, it is susceptible of extreme variety and modification."‡ * * * "In the pus of mammary abscess, the lactic and phosphatic salts are always abundant." * * * "Pus which is secreted by mucous surfaces often contains more fatty and saline matter, and almost constantly less albumen than the pus of serous surfaces; the former is also generally mixed with the secretion peculiar to mucous membranes." * * * "Pus from the nose contains an abundance of muriate of soda."§ This last-mentioned fact is in accordance with the two facts (1) that sodium chloride passes very readily by osmosis, and (2) is in great part left behind when a fluid containing it is subjected to evaporation.

THE ABSENCE OF CHLORIDES FROM THE URINE DURING THE ONWARD PROGRESS OF PNEUMONIA.

Many years ago it was learned by Redtenbacher, and since that time it has been verified by many observers that during the onward progress of pneumonia, chloride of sodium is absent from the urine. The quantity of chloride of sodium usually excreted with the urine depends greatly upon the quantity taken in with the food; but the average quantity is said to be about thirteen grammes per day.‖

* Dalton's Human Physiology, sixth Ed., p. 316.
† Samuel Wright, M. D., F. S. A., Edinburgh, in the Medical Times, London, 1844, p. 200.
‡ S. Wright, M. D., F. S. A., Medical Times, London, England, Jan., 1845, p. 321.
§ Same Vol., p. 322.
‖ Dalton's Physiology, page 49.

For several years the author of this paper tried to bring about such a series of analyses of the lungs of persons dead from pneumonia, and the sputa of persons sick with pneumonia, and a comparison with the results of analyses of lungs of persons who did not have pneumonia, as to learn if his hypothesis was correct, namely, that the chloride of sodium was in excess in the lungs of persons sick with pneumonia. Consultation was had with Prof. Prescott, of the Michigan University, and, afterwards, with Prof. Vaughan. Both agreed that the subject was important, but also that the following of undoubted cases through to a fatal termination, and securing the lungs after death, and the many other essential conditions, made the undertaking difficult to carry out. Holding the subject in mind, however, resulted in the finding of records of such work already performed, and which seemed, and still seems to the writer, to supply a "missing link" in the chain of evidence, which now seems complete, relative to the causation of pneumonia. In the Medico-Chirurgical Transactions, Vol. XXXV. (Vol. XVII. of the second series), published by the Royal Medical and Chirurgical Society, of London, England, in 1852, there is a paper "on the Diminution of the Chlorides in the Urine, or their absence from that fluid in cases of pneumonia, and on the Chemical Composition of the Sputa in that Disease," by Lionel Smith Beale, M. B. This valuable paper commences as follows:

"In August, 1850, Dr. Redtenbacher published some observations on the absence of chloride of sodium from the urine in cases of pneumonia.[1] This physician noticed that the quantity of chloride gradually diminished until the period of hepatization had occurred, when no traces whatever of the presence of salts could be detected in the urine, but the chloride again made its appearance as the resolution of the inflammation progressed." And continues: "It has been shown by the observations of Dr. Redtenbacher on eighty cases of pneumonia, that in this disease the chlorides are invariably absent, and that the salt disappears from the urine at the precise period at which hepatization occurs in the lung."

"Soon after the appearance of Dr. Redtenbacher's paper, I commenced a series of observations on the urine and other secretions in cases of pneumonia, with the view of making out, if possible, the channel through which the chloride of sodium was eliminated from the system in this disease, or the locality in which it was stored up during the persistence of the hepatization of the lung, and also with the hope of being able to trace the connection between the absence of the salt from the urine, and the occurrence of hepatization."

"My observations were made as opportunities occurred, on cases which were admitted into King's College Hospital."

"The cases were taken indiscriminately as they came into the hospital, and consequently, both mild and severe cases have been the subject of observation."

EXPERIMENTS PROVING THAT IN PNEUMONIA THE CHLORIDES ACCUMULATE IN THE SPUTA AND IN THE INFLAMED LUNG.

Mr. (now Dr.) Beale gives the details of the cases, and of the analyses of the urine, sputa, serum from blisters, of healthy and of hepatized lung, etc. Speaking of "Case III., ninth day of disease": "The sputa were no longer rusty, were less viscid, and were neutral to test-paper; 1,000 parts were found to contain:

		100 parts of the solid matter.
Water	941.53	......
Solid matter	58.47	......
Fixed salts	14.49	24.78
Chloride of sodium	5.92	10.12

[1] Zeitschrift der k. k. Gesellschaft der Aertze zu Wien. August, 1850.

"From an analysis of healthy pulmonary mucus, performed many years ago by Hasse, the quantity of salts corresponding to 100 parts of solid matter amounted to rather more than 18, while in the present instance we find very nearly 25 parts, the exact quantity contained in healthy urine. At the same time it will be observed that the sputa were very rich in the amount of chloride of sodium which they contained, although not a trace of this salt could be detected in the specimens of urine subjected to examination. In this case of pneumonia the following facts were observed:

1. A diminution of the fixed saline matters, generally, in the urine, and an increase of the organic constituents.

2. A total absence of chloride of sodium in the urine from the fifth day of the disease to the tenth day, when the patient was convalescent, and symptoms of hepatization were no longer to be detected.

3. A remarkable increase, compared with the quantity present in a state of health, in the amount of fixed saline matter in the sputa of the ninth day (the rusty character having disappeared on the previous day), and the presence of a considerable proportion of chloride of sodium."

Speaking of "Case VI.," Dr. Beale says: "In the analyses of the urine of the present case, the diminution of the quantity of salts generally and the increase of organic matter are well marked. The absence of chloride of sodium from the urine, even when convalescence was established, probably depended upon the persistence of the expectoration."

Speaking of "Case VII.," after giving tables of results of analyses, and statements of facts, Dr. Beale says: "This great excess of chloride of sodium in the serum of this patient a few days after resolution had commenced, probably depended upon the absorption of a large quantity of the salt which had been previously effused into the air-cells at the time when hepatization took place; and this appears still more probable when the fact of the presence of so large a quantity in the urine is considered: for in the analysis of the urine passed on May the 13th, it was shown that only traces of chloride were present; and in the analysis of sputa expectorated on the same day, the existence of an abundant amount of chloride was proved. Hence it would appear that on May the 13th there existed a decided determination of chloride to the lung, and that the force of attraction for this salt was such, as to reduce the quantity of it in the blood so much, that only traces were excreted in the urine. On the other hand, only three days later the attraction of the salt to the inflamed pulmonic tissue had not only ceased, but had given place to a force acting in the contrary direction; and now the chloride of sodium, which in the earlier part of the disease, had been caused to exosmose from the capillary vessels of the lung by reason of an active cell-forming process* proceeding in the inflammatory exudation external to them becomes reabsorbed by those same vessels, in consequence of the cessation of the cell-formation, and the necessary removal of the effused inflammatory products; and in this way the excess of chloride present in the serum is to be accounted for."

Relative to "Case IX.," an analysis of the sputa on the fifth day of the disease was as follows: "The sputa were slightly frothy, of a brown color, and in consistence and general appearance, much resembled very thick mucilage. The reaction was neutral, and the specific gravity 1,014. Upon the application of heat a bulky precipitate was thrown down. 491.5 grains of sputa were submitted to analysis and the results calculated to 1,000 parts:

		100 parts of solid matter.
Water	944.97	......
Solid matter	55.03	......
Albumen, mucus blood-corpuscles insoluble in boiling water	34.12	62.00
Extractive matter soluble in boiling water	12.84	23.33
Fixed alkaline salts	7.91	14.37
Earthy salts	.16	.29
Chloride of sodium	4.778	8.68"

Later, on the eighth day, sugar was found in the sputa; and Dr. Beale adds a foot note as follows: "To Dr. Todd I am indebted for the suggestion of testing pneumonic sputa for sugar; he considered that if the views of Bernard, regarding the changes taking place during respiration, were correct, sugar ought to be present in the sputa of pneumonia in sufficient quantity to be recognized by the ordinary tests."

*The writer of this paper does not accept this reason, but suggests that the inhalation of cold, dry air caused excessive evaporation of moisture and the accumulation of the chlorides in the lung; and that "three days later," after the patient was kept indoors and breathed air not so cold and dry, there was lessened evaporation from the air-cells, and therefore "a force acting in the contrary direction," the transuded chlorides returning into the blood-vessels.

After Case IX. was dead, portions of the lungs were analyzed, and an attempt made to compare the composition of the hepatized portion with a portion which appeared most healthy.

"Analysis A represents the composition of that part of the right lung which was found in a state of red hepatization, the patches of gray hepatization being carefully excluded. The specific gravity of the portion selected was 1051.6. 398.18 grains were evaporated to dryness.

"Analysis B represents the composition of the left lung, the portion selected for examination being that which appeared most healthy and free from congestion. 328.47 grs. were evaporated to dryness, and the result obtained calculated to 1,000 parts as in the previous analyses.

	A.	B.
Water	817.00	832.65
Solid matter	183.00	167.35
Extractive matter soluble in water only	38.93	11.97
Extractive matter soluble in water and alcohol .830	49.22	14.47
Alkaline fixed salts	7.72	7.46
Earthy salts	.93	2.71
Fatty matter	18.84	13.57
Albumen, pulmonary tissue, vessels, etc	67.35	117.17
Chloride of sodium	2.59	1.43"

From the data obtained in these analyses, the composition of 100 grains of solid matter of the lungs was calculated:

	A.	.
Solid matter	100.00	100.00
Extractive matter, soluble in water only	21.27	7.15
Extractive matter, soluble in water and alcohol .830	26.90	8.65
Alkaline fixed salts	4.22	4.46
Earthy salts	.51	1.61
Fatty matter	10.29	8.11
Albumen, pulmonary tissue, vessels, etc	36.80	70.01
Chloride of sodium	1.41	.85"

Dr. Beale accounts for the chloride of sodium being present in increased quantity in the lung during inflammation, through an "exalted attraction for chloride on the part of those textures concerned in the formation of the characteristic expectoration of pneumonia. The precise tissue concerned in the secretion of viscid* sputa which contains so much chloride is probably the mucous membrane of the smaller bronchial tubes, for it has doubtless the office of separating a certain quantity of saline matter from the blood in a state of health, and therefore when the mucous membrance is inflamed, and the cell-formation is more actively taking place in the finer ramifications of the bronchial tubes, a more abundant secretion of the substances concerned in the building up of these cells must take place. The development of mucous corpuscles and those peculiar cells containing minute oil-globules, which are usually found in the ordinary pulmonary mucus, and which are so abundant in the sputa of pneumonia, is probably intimately connected with this separation of saline matter from the blood." †

* Later in this paper, facts are stated which tend to prove that the exudation of the albuminous constituents of the blood is sometimes caused by the presence of the chlorides on the mucous membrane.

† Later, Dr. Felix Hoppe, after experimenting on the passage of albumen out of the serum into a salt solution, expressed himself with reference to albumen (and possibly a similar explanation may apply to the "mucous corpuscles and those peculiar cells containing minute oil-globules which [according to Dr. Beale], are usually found in the ordinary pulmonary mucus"), as follows: "But further researches showed that the amounts of albumen going over were not in relation to the amount of salt solution entering into the serum, but that this amount was dependent on the rapidity and amount of the water entering the salt solution out of the serum. The albumen is carried with the water stream as the river water carries with it the sand and mud." (Virchow's Archiv, Vol. 9, 1856, pages 265-7.)

"Whether chloride of sodium be essentially necessary to the growth and development of the peculiar nonnucleated cells, to which reference has just been made, I have not yet been able to determine by my own observations; but in many instances in which these bodies were abundant the presence of much saline matter which contained a considerable proportion of chloride of sodium was proved."

It seems to me that in the light of what has been shown, and what is shown in this paper, the presence of an increased proportion of chloride of sodium in the sputa of persons sick with pneumonia is easily explained; and that the character of that "attraction" referred to by Dr. Beale can now be described somewhat as follows: In passing from the blood-vessels into the air-cells and bronchial tubes the water takes with it the salts of the blood, perhaps especially the chloride of sodium; this salt does not readily pass out from the lungs with the vapor of water, and although normally, on account of endosmosis and the action of the lymphatic system, no accumulation occurs, yet, under certain conditions, when the air inhaled is unusually cold and dry, and evaporation and transudation of the saline fluid is consequently excessively rapid, this salt accumulates in the air-cells and bronchial tubes. (That chloride of sodium does in small quantity readily pass off with vapor of water is well-known; but it is even more well-known that it tends to accumulate whenever water containing it is vaporized. That is the way common salt is made commercially, namely by evaporating sea-water or other water containing that salt.)

PNEUMONIA IS SOMETIMES SELF-LIMITED. A PREDISPOSING CAUSE OF PNEUMONIA.

The quantity of salt which may thus pass into the air-cells depends upon several factors besides the rapidity of the transudation, for it has been proved * that not all the sodium chloride will pass out from an albuminous solution into distilled water, and, although the researches of Drs. Redtenbacher, Beale, and others have proved that during the onward progress of pneumonia the tendency of the chlorides to the lung is often so strong that no chloride is then found in the urine, there must come a time in that disease when the blood will be too poor in chlorides to part with more, even to fill the demand caused by excessive evaporation from the surfaces of the air-passages. This may help to explain why pneumonia is sometimes "self-limited." And, if so, it will also help to explain the insusceptibility of persons who do not have pneumonia, although exposed, apparently, to the same conditions as are those who do have it. But when food or drink containing chlorides is freely given to the patient, limitation of the disease by reason of lack of chlorides cannot occur. And it seems reasonable to believe that among persons whose food consists in great part of salted meats, etc., the tendency toward the accumulation of the chlorides on the surfaces of the air-passages, on exposure to the inhalation of cold, dry air, must necessarily be greater than among persons whose food does not contain much of those salts. Laboratory experiments bearing on this subject are much needed, however, in order to definitely settle the question of the predisposing causes of pneumonia. If it proves to be true, as appears from the evidence which I

* By Dr. Felix Hoppe, Virchow's Archiv, Vol. 9, 1856, pages 245-268.

have been able to obtain, that the salinity of the food and drink* is an important predisposing cause of an irritating transudate on the mucous surfaces of the air-passages, it may explain why, as is alleged, pneumonia frequently occurs among residents in the warm, moist climates of some of the southern United States,† where salted bacon and other salted meat is much used for food, and why pneumonia is not more frequent in the arctic regions where food may be kept without the necessity of adding salt.

Much of what has been written in text-books, of the part which sodium chloride takes in the osmotic movements of fluids in the body, has been based upon experiments in osmosis through membranes outside of the body; but Dr. O. Lassar ‡ in the Pathological Institute, at Breslau, has experimented with the living bodies of animals, especially of the dog, with a view to learning the different characters of lymph transuded from healthy tissues and exuded from inflamed areas, and the influence which the intra-venous injection of a dilute solution of sodium chloride has on the exudation of lymph in inflamed areas. Dr. Lassar found that the lymph from inflamed tissues differed from that from the normal tissues as follows: The inflammation lymph is a yellowish, opalescent, tough fluid, which, immediately after the outflow, and often in the canule, coagulates to thick lumps, and contains only a few red blood corpuscles, but a large quantity of white corpuscles; on the other hand, the lymph from the normal tissues is a thin, flowing, light-red, slowly and incompletely coagulating fluid, abounding in red blood-corpuscles, with a very small amount of fibrin. The per cent of dry residue obtained from the lymph from inflamed areas was much greater than that from the healthy tissues. The average of several experiments showed that lymph from inflamed areas had 6.6 per cent of dry residue, while the lymph from parts not inflamed had 3.52 per cent. The concentration increases for a time with the duration of the inflammation; inside of the first 24 hours it increases gradually and constantly, then it often becomes constant. On the other hand, the transudate from healthy tissues makes its appearance from the beginning in a high degree of attenuation.

INFLAMMATION-LYMPH CONTAINS MUCH MORE SALT THAN NORMAL LYMPH DOES.

The dry residues obtained from the different experiments by Dr. Lassar were gathered together and dried over sulphuric acid. So far as the material reached, analyses were made of the ash:

Of the inflammation-lymph 6.6 per cent was dry residue. Then 1,000 parts of dry residue represent 15,151 parts of inflammation-lymph, because 1,000 is 6.6 per cent of 15,151. One thouand parts of the

* Henry M. Field, M. D., in a paper on "Treatment of Constipation," read before the Gynæcological Society of Boston, May 20, 1886 (abstracted in the College and Clinical Record, Oct. 1, 1886, p. 191), (published in the Journal of the American Medical Association, Sept. 11, 1886, and the Journal of Reconstructives, Jan.. 1887, p. 21), states:

"1. The salines do not commonly agree with the aged; they find them too chilling; and a dose of epsom salts, which may operate very kindly upon the young and middle-aged and vigorous, may bring serious disaster to the old man or old woman. A sudden depression of vital energy and the function of calorification thus procured, together with other favoring circumstances, have more than once precipitated the subject into a fatal pneumonia."

† Sanders, in the Am. Jour. of the Med. Sciences, July, 1882, p. 93.

‡ "*Ueber œdem und Lymphstrom bei der Entzündung.*" *Virchow's Archiv, 1877, Band 69, Seite 516–530.*

dry residue from the inflammation-lymph yielded 137.67 parts of ash; while 1,000 parts of the dry residue of the stowing lymph * yielded 112.83 parts ash.†

It is stated† that in 100 parts of ash there are 76.086 parts of sodium chloride. In one part of ash there are then .76086 parts of sodium chloride, and in 137.67 parts of ash there are 137.67 × .76086 or 104.74 parts of sodium chloride. That is there are 104.74 parts of sodium chloride in 137.67 parts of ash, or in 1,000 parts of dry residue from inflammation lymph, or in 15,151 parts of inflammation lymph. If there are 104.74 parts of sodium chloride in 15,151 parts of lymph, in one part of lymph there are $\frac{104.74}{15,151}$ of sodium chloride, and in 1,000 parts there are $1,000 \times \frac{104.74}{15,151}$ or 6.9 parts of sodium chloride.

Of the normal lymph ("stowed" lymph), 3.52 per cent was dry residue. Then 1,000 parts of dry residue represent 28,409 parts of stowed lymph, because 1,000 is 3.52 per cent of 28,409.

On page 530 it is stated that in 1,000 parts of dry residue from stowing lymph (that is to say in 28,409 parts of normal lymph) there are 112.83 parts of ash. On the same page it is stated that in 100 parts of ash there are 74.429 parts of sodium chloride. Then in one part of ash there are .74429 part of sodium chloride. In 112.83 parts of ash there are 112.83 × .74429 or 83.978 parts of sodium chloride. That is, there are 83.978 parts of sodium chloride in 28,409 parts of normal lymph. Then in one part of lymph there are $\frac{83.978}{28,409}$ parts of sodium chloride. In 1,000 parts there are $1,000 \times \frac{83.978}{28,409}$, or 2.9 parts of sodium chloride.

Prof. Flint states the normal amount of sodium chloride in the blood as between 3 and 4 parts per thousand. It thus appears that the lymph from the well tissues in the dog gave a proportion of sodium chloride slightly less than is in normal human blood, while the lymph from the inflamed tissues contained about twice as much sodium chloride as there is in normal human blood.

On May 23, 1876, a large dog weighing 11,410 grammes was experimented with by Dr. Lassar. The day before 4 ccm. emulsion of oil of turpentine had been injected in the right side of his face, and 2 ccm. of petroleum emulsion in the right hind foot. The right side of his face was enormously swollen and the right foot thick and hot. Out of the lymph stem which was concerned, there dropped rich, yellow, clear, body-rich lymph.

Within 75 minutes a solution of cooking salt of 0.6 per cent of sodium chloride at 38°-40° C. was injected into the jugular and femoral veins, in all 5,600 grm. In the inflamed parts the lymph secretion was very much hastened (in the normal throughout not).

	Dry Residues.
1. Neck inflammation-lymph	5.90 per cent.
2. "Hydræmish" neck lymph (infl.)	2.97 " "
3. Foot-lymph (infl.)	5.89 " "
4. "Hydræmish" foot-lymph (infl.)	3.11 " "

With other like experiments the result was as follows: The inflammation lymph gave before the "hydræmising" 6.48 per cent fixed residue, after the same 3.80 per cent fixed residue, before 6.57, after 2.94. (Seite 529.)

The supposition is that these are the results immediately after the dilute solution of salt was injected into the veins. If the salt had had time to pass out into the inflamed area, the result might have been different, as also it might if the quantity of salt in the fluid injected, had been greater. Experiments modified in these particulars are needed to give the information here sought. But the phenomena in such cases as described in these experiments must be different in one respect from those which occur in inflammation of the lungs and air-passages, because the conditions are not the same, in the air-passages evaporation is constantly taking place, so that the tendency

* In Dr. Lassar's experiments, the lymph from healthy tissues is spoken of as "*Stauung's lymph*" or stowed lymph.
† See pages 530, Virchow's Archiv, Vol. 69, 1887.

toward equal salinity on both sides of the pulmonary mucous membrane is constantly being overcome, as is indicated by the fact that the mucus in those situations is more saline than is the blood.

The most natural interpretation, and the one which Dr. Lassar evidently put upon his experiments, seems to be that, by means of the intra-venous injection of the dilute salt solution, he "hydræmised" the blood—made it more watery—and that thereby the flow of lymph was hastened, and the lymph was made more watery, its amount of dry-residue being very greatly decreased. The inference is strong that by injecting salt in such strength as to make the blood more than normally saline, that is to say less watery than normal, the immediate flow of lymph might be made slower, and its proportion of dry residue increased; and that, after the abnormal proportion of salt has passed out from the blood, and has accumulated in the inflamed parts, the flow of lymph may be increased again. If by watering the blood—making it *less* saline than normal—he makes inflammation lymph approach in character normal lymph, it is reasonable to infer that if one makes the blood *more* saline than normal, any normal lymph transuded may approach in character inflammation lymph. In other words, *the presence of salt in the blood in abnormally large amount may constitute a condition of the blood which tends toward the occurrence of inflammation.*

If we can learn the condition of the blood predisposing to inflammation in general, it seems very desirable to do so, and such evidence seems to bear upon the question of predisposition to pneumonia.*

HYPERINOSIS,† AND THE CHLORIDES IN THE BLOOD.

Hyperinosis is a generally accepted predisposing cause, or at least accompaniment of inflammation; and the experiments by Dr. Lassar referred to on pages 296–297, have just shown that inflammation-lymph differs from normal lymph by containing more salt, but also a much larger proportion of fibrin, therefore anything bearing upon the production of hyperinosis may bear upon the causation of pneumonia, particularly as excess of fibrin in the blood is a prominent fact in the history of pneumonia, as proved by the "buffy coat" on blood drawn from persons sick with pneumonia.

Hyperinosis may profitably be studied in connection with the subject of atmospheric ozone, because ozone is an active oxidizer, and fibrin is probably formed by the oxidation of albumen; therefore the subject may be treated of in that connection; but the subject may also be studied in this connection, before proceeding to the attempted explanation of the prominent fact in croupous pneumonia, namely the great accumulation of a fibrinous deposit in the air-cells in the lungs.

Speaking of drugs which favor the absorption of oxygen, or set free oxygen in the human system, M. Albert Robin is reported‡ as having mentioned (Gazette Medicale, de Paris, December 25, 1886), as "among the agents which will fulfil this indication are alcohol in small doses, common salt,

* In this connection it is of interest to study a general law of osmosis as it relates to albumen, and the passage of albumen through membranes to saline solutions, as set forth in Dalton's Physiology, quoted on page 300 of this article, and more fully detailed by Dr. Felix Hoppe, as mentioned on page 304; also to study the oxidizing effects associated with the chlorides, pages 298-9, and the relation which pneumonia has to atmospheric ozone, pages 307-10; also the oxidizing influences apparently due to cold alone, pages 310-11.

† The non-professional reader may be interested to know that this one word "hyperinosis" stands for excess of fibrin in the blood.

‡ The Medical Age, Detroit, April 11, 1887, pp. 166-7; also Journ. of Am. Med. Assoc., Jan. 15, 1887.

the alkalies, the salts of organic acids, and the free ingestion of liquids." And again: "As to the chlorine salts, while they furnish some oxygen to the system, they must be given in large doses for this purpose; and as these large doses are toxic, these salts should be rejected."*

The action of common salt in the organism is worthy of careful study, because although not often prescribed by physicians, it is in general use in food by the people. As an oxidizing agent in the body, it is especially worthy of close study in connection with pneumonia, in which disease there is an increased proportion of fibrin in the blood; fibrin being, practically, oxidized albumen. Among substances which favor oxidation, common salt is, by M. Albert Robin, named second in the order, while alcohol is the first named. Alcoholic liquor as a beverage has long been associated with the causation of pneumonia, and it is worthy of investigation whether some part of the influence of alcohol may not be toward an increased proportion of fibrin in the blood; and a similar remark may be made with respect to common salt.

Bearing upon the subject of the formation of what has been called a "fibrinous" exudate in the air-cells of the lungs in pneumonia, it may be noted that recent experiments show that "egg albumen is not affected by hydrogen peroxide when in an alkaline or neutral solution, but in an acid solution in the presence of sodium chloride, hydrogen peroxide causes the albumen in a few minutes or hours to be changed into a proteïd, insoluble in water." * * * "The precipitate caused by hydrogen peroxide is stated to be a mixture of gelatinous acid albumen with a large quantity of proteïd, very similar to caseïn." "In order to obtain the precipitate, acid, sodium chloride, and hydrogen peroxide must all be present, but acetic, phosphoric, or sulphuric acids may be substituted for lactic acid." "Lactic acid and sodium chloride are both present in sweat, and hydrogen peroxide can also be shown to be present; * * * as it also is in certain tissues."†

"The secretions of the body are also strongly oxidizing, in virtue of the hydrogen peroxide they contain."‡ The quantity of sodium chloride employed to cause the precipitation is "20 c. c. of a 5 per cent solution added for every 100 c. c. of albumen."§.

THE CAUSATION OF THE FIBRINOUS EXUDATION IN PNEUMONIA.

The exosmosis of chloride of sodium into the air-cells and bronchial tubes having been explained, and also the accumulation of such salts there through unusual evaporation caused by the breathing of air unusually dry, it is now in order to point out more completely than has been done how the albuminous and fibrinous constituents of the blood are caused to exude into the air-cells; because, although bronchitis ‖ may be caused without much albumin-

* The Medical Age, Detroit, April 11, 1887, pp. 166–7; also Journ. of Am. Med. Assoc. Jan. 15, 1887.
† Abstract of paper by C. Wurster, in Journal of the Chemical Society, London, June, 1887, pages 607–8.
‡ Same author, same Jour., page 612.
§ Ibid, page 607.

‖ BRONCHITIS AND OTHER DISEASES OF THE AIR-PASSAGES.—Diagram No. 13 shows that in Michigan bronchitis sustains relations to atmospheric temperature similar to those of pneumonia. I have found that this is true in other parts of the world; and it may be remarked that the statistics compiled and diagrams prepared by me show (conclusively as I think) that not only bronchitis but tonsilitis, croup, diphtheria, and influenza are all controlled, directly or indirectly, by the atmospheric

oid exudation, croupous pneumonia implies much of such an exudate. Prof. Dalton, on page 363 of his treatise on Human Physiology for the Use of Students and Practitioners, says: "But a substance like albumen, which will not pass out by exosmosis toward pure water, may traverse a membrane which is in contact with a solution of salt. This has been shown to be the case with the shell membrane of the fowl's egg, which, if immersed in a watery solution containing from 3 to 4 per cent of sodium chloride, will allow the escape of a small proportion of albumen. Furthermore, if a mixed solution of albumen and salt be placed in a dialysing apparatus, the salt alone will at first pass outward leaving the albumen; but after the exterior liquid has become preceptibly saline, the albumen also begins to pass in appreciable quantity." Not finding mention of this fact in other works on physiology or chemical physics, I attempted to verify the statement by a few experiments. I did not find albumen in solution in the exterior liquid, but I did find a coagulum. I am not an expert in that line of investigation. A recent letter from Prof. Dalton informs me that he has seen no reason to change the statement in the foregoing quotation.* It therefore seems probable that the characteristic exudation in pneumonia is brought about, or at least favored, by the extraordinary and long-continued demand upon the air-cells for water, which occurs through the inhalation of cold, dry air; this extraordinary evaporation of water leaving in the air-cells an unusual quantity of the salts of the blood-serum, more especially the chlorides, which not only act as an irritant, favoring the passage of the white-blood corpuscles, but also favors the exudation of the albuminous constituents of the serum.†

That the exudate in the air-cells is ultimately fibrinous, may be explained without difficulty in several ways, but just which is the actual way in the greatest proportion of cases it is not so easy to say. Perhaps, according to Bizzozero, Hayem, Eberth, Osler, and others, the blood-plaques may account for it. But the oxidizing influence of ozone, sodium chloride, etc., may well be considered.

PNEUMONIA NOT AS EASILY CAUSED AS BRONCHITIS.

The statistics which I have studied seem to prove that bronchitis is easier caused than pneumonia is, and may indicate that in order to cause the exudation which occurs in croupous pneumonia there is required a greater concen-

temperature, as are also certain other diseases which gain entrance to the body by way of the air-passages, small-pox and consumption increasing after the coldest weather, and decreasing after the warmest weather. (Since this paper on pneumonia was prepared, two other papers, containing some of the evidence just referred to, have been read by me, one on "Some of the Cold-Weather Communicable Diseases," published in the Trans. of the Mich. State Med. Soc. for 1887, the other is to be in the Trans. of the International Med. Congress, held in Washington, D. C., in 1887.) Dr. A. Seibert, of New York, has for several years been studying the relations of pneumonia and of bronchitis to weather, and he has found that both diseases sustain relations to atmospheric temperature similar to those shown in my diagrams. His diagrams included statistics in New York and in Germany. He has thought that relative humidity has caused relations to those diseases; but, as explained on a preceding page, I find no very close relations. An interesting paper on "The Weather and Croupous Pneumonia," by Dr. A. Seibert, is published in the *Berliner Klinische Wochenschrift*, 1884, pp. 273 and 292.

* Some account of the experiments by Brücke and by Hoppe, upon which the law stated by Prof. Dalton is probably based, is given further on in this article, under the head of "The Osmosis of Albumen," page 304.

† The part which is played by local paralysis may be treated of in another part of this article; as also the influences of obstruction of the circulation through structural or functional impairment of the heart.

tration of the non-volatile salts than is required to cause bronchitis; thus, by comparing Diagram No. 1, page 252, with Diagram No. 13, page 276, it may be seen that bronchitis increases more rapidly than pneumonia does when cold weather comes on in the autumn, and it also continues a little longer in the spring; also, that of all reports received throughout the year only an average of about forty* per cent state that pneumonia was observed, while sixty-two† per cent state that bronchitis was present—showing a much greater prevalence of bronchitis than of pneumonia, among absolutely the same people, and under meteorological conditions and other circumstances precisely the same.‡

INFLAMMATION-FLUIDS (EXUDATES) CONTAIN MORE ALBUMEN THAN DO TRANSUDATES FROM HEALTHY TISSUES.

Doctor Adolph Reuss, assistant physician of the Medical Clinic in Tubingen, has published § results of numerous analyses of fluids from different parts of the human body in health and in disease, showing the proportion, in each, of fixed residue, organic matter, albumen, fibrin,‖ and salts. He does not seem to recognize any considerable differences in the proportions of salts; but he mentions, (page 583), that the exudation pleuritic fluids contain more than twice as much organic matter as do the transudates.

Some of the conclusions by Dr. Reuss are as follows:

If we place together in a table the experiments referred to in paragraphs I-IV, we will see:

1. With the transudates [from parts not inflamed], as indorsed by Smith's many statements, the different capillary groups yield fluids of different compositions, and those from the pleura peritoneum, subintegumental cellular-tissue and brain-capillaries yield quantities of albumen, decreasing in the order named [1]

2. But it is questionable if this proposition will hold good with the exudates [from inflamed parts]; in regard to that, we cannot come to a conclusion now, because our material is yet too heterogeneous; but I think it will not hold. At least, everything still appears to me to indicate that every idiopathic inflammation of the same intensity, in any part of the body, yields an exudate containing about the same amount of albumen. (See table with proposition 7.)

3. We can probably use the proposition still further with the exudates, that the albumen increases with the degree of inflammation; purulent fluids have more solids than serous fluids, sanious more, at least of organized matter, than purulent.

4. Inflammation fluids, such as have less albumen than those exudates coming from primary inflammation, are either transudates which come from near some inflammatory process, or exudates from dropsical (*hydrämische*) persons.

5. For in the second series the composition of the exudates showed the influence of the condition of the blood as much as did that of the transudates, (The duration of the transudation, and the rapidity of the circulation, are items which I have not sufficiently considered in this work.)

6. It is often hard to decide whether a fluid is of an inflammatory nature or not, because it can be both, and therefore it is impossible to place a common limit in figures.

7. But I thought in my compilation to be able to place an average ideal limit for the minimum of the pure exudates, and for the maximum of the pure transudates from the different capillary systems, as follows:

[1] Published by Schmidt in "Liebig's Annalen," vol. 66, page 352, and in "Charakt. der épidemischen Cholera," page 146 there, with the modification that the last two were transposed.

* Table 2, page 251, shows that it is 39 per cent.
† Table 22, page 277, shows that it is 62 per cent.
‡ This is true, as shown by tables and diagrams for the same period of time, 8 years, 1877-84, but in Table 22 and Diagram No. 13, one year has been added, making the period 9 years.
§ Beiträge Zur Klinischen Beurtheilung von Exudaten und Transudaten; in Deutsches Archiv für Klinische Medicin, 1879, Vol. 24.
‖ He says: "The fibrin, which was formerly denied the transudates, can be found or formed, even if mostly in trifling quantity. On the other hand, the fibrin fails completely in the purulent fluids, even if it had been formerly present in the serous exudate."

Usual amount of Albumen.	With the Exudates more than:	With the Transudates less than:
In the pleura	40	25
In the peritoneum	40 (45)	15 (—20)
In the skin	40	10 (—15)
In the brain	?	5 (—10)

ŒDEMA OF THE LUNGS, CAUSED BY SALT.

From what has been presented in this paper, it may be supposed that an excess of salt in the blood is favorable to the causation of pneumonia *whenever the person is exposed to the inhalation of air unusually dry.* Let us suppose an unusual excess of salt in the blood, and the person not exposed to the inhalation of unusually dry air. It may be supposed that the salt will be excreted by the kidneys in unusual quantity, irritating the kidneys in its passage out through them; and that the increased flow of urine will carry with it albumen; that the fluid transuded into the air-cells in the lungs and into the air-passages will be unusually saline and, inasmuch as no excess of fluid will be evaporated, there is likely to be an accumulation there of an abnormally saline, irritating, and albuminous fluid, in other words that there will be œdema of the lungs. Just this has been proved to occur in animals poisoned by sodium chloride, and also in animals poisoned by the chlorate; but these effects have been supposed by the experimenter (if I understand him correctly) to have been produced in a different manner. Inasmuch, however, as the experiments seem to the writer of this paper to have a bearing upon the subject under discussion, a brief abstract is here given:

Dr. B. J. Stokvis, in an article on "The Cause of the Poisonous Action of the Salts of Chloric Acid,"* has recorded the results of experiments which prove to him that the toxic effects of the chlorate of soda are the same as those of the chloride of sodium, and that the poisonous dose is the same. He has determined the effects of fatal and of non-fatal doses, and of its introduction through the mouth, and through intravenous injection. Speaking now of the chlorate, he says: "In the corpses of animals dead through intravenous injections, there are found no changes worthy of mention except a never-failing œdema of the lungs; the kidneys are somewhat hyperæmic; the spleen, liver, etc., show themselves altogether normal."† * * * "The toxic and deadly workings of this intravenous-injected chlorate is in all respects similar to that of concentrated solution of cooking salt. Neither in the symptoms of the poison nor in the doses does any difference appear between the cooking salt and the chlorate of soda. Under both circumstances it is not the substance introduced as such which has the deadly effect; it is much more the concentrated salt solution which, most probably, exercises first an irritating then a depressing effect on the central nervous system, which affects the kidneys, and must be considered as the cause of the œdema of the lungs." * * * "With salt taken internally, the deadly dose, for both substances, consisted of 8 to 10 grammes per kilogram of animal. The first appearances consist here in a certain debility and apathy of the animal, in a pointed increase of heart frequence, with dyspnœ, in no strong diminution of heart frequence, while a little later the muscular contractions occur, and are not generally so severely expressed as in the intravenous injections.‡ In a half hour or an hour after the administration of this large amount of concentrated salt solution the animal becomes more or less paretic in the side, the respiration becomes harder, the frequence of the pulse is lowered, there occur meanwhile several hard convulsions which spread over the whole body, and the animal dies with dyspnœ. Meanwhile diarrheas

* *Archiv für Experimentelle Pathologie und Pharmakologie; Band 21, Hefte 2 und 3, Seite 170-218.*
† *Seite, 206.*
‡ Page 207.

occur not constant throughout, and the urine passed during the poisoning always contains, as mentioned before, albumen and chlorate."*

DIET, AND CONDITIONS OF THE BLOOD POSSIBLY PREDISPOSING TO PNEUMONIA.

Soon after an extraordinary snow storm, in April, two persons in a family of seven under my observation were taken sick. The only circumstance noticed which bears upon the present study was the fact that at the supper those two persons ate more heartily than others of salt dried halibut. One, a child about four years old, was taken sick that night with severe croup. The next day he was hoarse, coughed some, and had a fever, afterwards for some days he had a troublesome cough, especially nights. The other person, an adult, was taken sick the next day with "sore throat." His throat was red and irritable, and pained him so as to interfere with sleep for one or two nights. He noticed that the sputa he raised tasted salty; soon he also began to cough.

By themselves these observations teach nothing, but if a sufficient number of such observations can be made, it may be possible to learn much about what it is that constitutes susceptibility to inflammation of the air-passages.†

The history of pneumonia supplies facts which seem to indicate that at certain times when, and places where scurvy prevailed, pneumonia was also present.

Thus, in an account of outbreaks of pneumonia in the Akerhus Prison, Christiana, it is said: "A former similar outbreak in the prison occurred in 1847, and coincided with a prevalence of *scurvy.*" ‡ Again, Drs. Grimshaw and Moore, speaking of Ziemssen, of Berlin, say: "This author further believes that the death-curves of pneumonia and *typhus* are remarkably parallel, and he concludes that 'pneumonia will be most frequent when *influences predisposing to diseases of the lungs combine with others which predispose to typhus,*' of which a remarkable example is afforded by the prevalence of almost double the previous mortality from pneumonia in Denmark and Ireland during the famine years, 1845–49, when typhus, dysentery, intermittents, and *scurvy*, raged." § Again, "Dr. Bryson [a] describes a very remarkable epidemic of pleuro-pneumonia, in some ships of the Mediterranean Fleet, in 1860. The disease was of a low, asthenic type, accompanied with great congestion of lungs, and in many cases, on board the ship chiefly affected—the St. Jean d'Acre—with *scorbutic symptoms.*"‖

Dr. Sturges¶ states that there run through the ancient accounts of pneumonia, no less than the modern ones, two leading characters: "There is the wide-spread and often desolating epidemic associated with some unhealthy conditions of living, such as famine, bad lodging, and overcrowding, and

*Page 208.

†My friend, Dr. J. H. Kellogg, of Battle Creek, mentions the fact that a vegetarian, a man opposed to the use of salt, contracted pneumonia, and died with it. Of course, it is possible that in some unknown way he ingested an abnormal quantity of salt. But it is more likely that the disease was brought about by some other agent than sodium chloride. Further on in this article, it appears from experiments by Dr. Felix Hoppe, that the exudation of albumen which occurs toward a solution of sodium chloride occurs also toward a solution of calcium chloride, potassium nitrate, or solution of urea; and any one or all of these may have been left on the mucous surfaces of this man by excessive evaporation of vapor through the inhalation of air unusually dry.

‡Drs. Grimshaw and J. W. Moore, the Dublin Journal of Medical Science, May, 1875, p. 405.

§Dublin Journal of Medical Science, May, 1875, p. 404. The word "*Scurvy*" italicised by me.

a The Lancet, Jan. 9, 1864. See New Syd. Society Year-Book for 1864, p. 139.

‖Dublin Journal of Medical Science, May, 1875, p. 406.

¶Octavius Sturges, M. D., F. R. C. P., The Natural History and Relations of Pneumonia, page 13.

bringing in its train other affections like dysentery and scurvy; and there is the disease called by this same name, prevalent more or less according to weather and exposure, less fatal than the first and without its accompanying diseases."

An editorial in the London Lancet, June 24, 1882, page 1048, states: "There is increasing evidence to show that, though scurvy in its completely developed form rarely occurs at the present time, minor manifestations of the disease are less uncommon than is generally supposed." * * * "Dr. Ralfe has pointed out the close resemblance that exists between gout and scurvy in its early stages, and has suggested that the primary change in both is due to a chemical alteration in the quality of the blood; in the direction of diminished alkalinity. In gout, as Dr. Garrod has found, the serum reaches the neutral point more nearly than in other diseases. This diminished alkalinity in gout, Dr. Ralfe suggests, is due to the introduction of acid salts taken in excess with the food and drink, whilst in scurvy it results from the absolute withdrawal of the alkaline salts supplied by fresh fruit and vegetables."* W. R. Thomas, M. D., M. R. C. P., Lecturer on Medicine at the Sheffield Medical School, etc., says (in Clinical Remarks printed in the London Lancet, August 29, 1885): "I feel that many of the cases of pneumonia we meet with are local exhibitions of gout accompanied by the febrile symptoms met with in such cases, and this should certainly be remembered in treatment."

THE OSMOSIS OF ALBUMEN.

Reference has been been made † to a law in osmosis, stated in Dalton's Physiology, that although albumen will not pass by osmosis through an animal membrane to pure water, it will pass to a solution of salt. As this fact seems to be an important one, reference to the experiments which have led to this conclusion may be of value in this connection. According to Dr. Felix Hoppe: ‡

"Brücke first pointed out that albumen was not able to diffuse itself through animal membrane into water. Repetition of the experiment with blood-serum on the one side and distilled water on the other side of a swine's bladder gave me [Dr. Hoppe] the same result. A large part of the dissolved salt contained in the blood-serum goes into the distilled water, and the chlorine can be found there after a short time; also alkaline phosphates go over; but with a large flat surface of contact to both fluids (relative to their volume) only weak traces of albumen are found in the distilled water used, after 24 to 48 hours' diffusion." * * * "Certainly a large part of the salts goes over into the distilled water through the membrane, and new distilled water takes away new salt' but I did not in this way succeed in separating all of the sodium chloride out of the blood-serum, even if the amount remaining was very small."

"Hence it follows with certainty that the sodium in the blood-serum, which gives its alkaline reaction, does not leave the albumen in the presence of a large amount of water, the attraction of the water for the sodium is not so pointed, at the usual temperature, as the attraction between the sodium and the albumen. If in the above experiments one takes salt solution instead of distilled water, a much more pointed amount of albumen is soon found than can be obtained by a long diffusion in distilled water. Frequent repetition of this experiment with sodium chloride, chloride of calcium, saltpeter, and with solution of urea gave the same results; lactic acid, or solution of creatin, gave no more albumen than distilled water. On this ground I [Dr. Hoppe] was led to conclude that albumen in distilled water could not diffuse itself through porous membrane, that on the other hand it could exchange itself endosmotically against salt. But further researches showed that the amounts

* London Lancet, June 24, 1882.
† Page 300.
‡ Virchow's Archiv, Vol. 9, 1856, pages 245-268.

of albumen going over were not in relation to the amount of salt solution entering into the serum, but that this amount was dependent on the rapidity and the amount of the water entering the salt solutions out of the serum. The albumen is carried with the water stream as the river water carries with it the sand and mud."*

In this connection, Dr. Hoppe states several facts and reasons for the belief that the albumen in the blood is not absolutely in solution, but is particulate. He seems to think that this has a bearing upon the subject of the transudation of albumen, and perhaps it does help to explain the reason why the largest quantity of albumen is carried by the most rapid movement of the serum out of the vessels to a saline solution.

Dr. Hoppe's conclusion—that the transudation of albumen is quantitatively in proportion to the rapidity of the transudation of the water of the serum, seems to be a very important one, precisely in harmony with the fact which I have shown—that pneumonia is quantitatively in proportion to the coldness and dryness of the atmosphere inhaled, and consequently in proportion to the demand upon the air-passages for fluid to maintain them in the moist condition essential to the continuance of life.†

To my proposition—that the osmosis of albumen to a salt solution probably has some causal relation to pneumonia, one physician has offered the objection that he could not imagine how a salt solution could collect in sufficient quantity in the air cells or alveolar cavities in the lungs. To this it may be replied that this law of osmosis probably applies to a single drop of fluid as completely as to a pint, and that it is even more difficult to conceive of the surfaces of the alveolar cavities being dry than to conceive of them as filled with fluid. In order that the function of respiration shall continue, those surfaces must always be moist; and after the inhalation of air unusually dry, the residue of salt left by evaporation of the fluid must be unusually large, although probably all dissolved. Inasmuch as the moisture of the surfaces must be maintained, the osmosis is hastened by the unusual evaporation. According to Dr. Hoppe's experiments, the hastening of the osmosis causes the passage of albumen in proportion to the hastening; and, irrespective of the hastening due to rapid evaporation of the fluid, the osmosis would be hastened and the albumen caused to exude by the presence of the salt solution on the surfaces of the alveolar cavities; because, as stated by Prof. Dalton,‡ "a larger quantity of water will pass toward a dense solution than toward one which is dilute."

"When an animal membrane, accordingly, is placed in contact with two different liquids, it absorbs one of them more abundantly than the other; and if that which is absorbed in the greatest quantity is also readily diffused into the liquid on the opposite side, a rapid endosmosis will take place in that direction, and a slow exosmosis in the other. Consequently the least absorbable fluid increases in volume by the constant admixture of that which is taken up more rapidly."§

In this connection it should be remembered that the experiments by Lionel S. Beale‖ proved that the sputa and the inflamed lung contained more

---

* Pages 265–267.

† Inasmuch as Dr. Hoppe's investigations were published in 1856, it might have been more proper to have said that the facts which I present are in harmony with and corroborate his conclusions; but the text above was written directly after seeing, for the first time, Dr. Hoppe's article, which was not until after my own conclusions had been published; and his work had no reference to the causation of pneumonia.—H. B. B.

‡ Human Physiology, p. 362, 6th edition, Phila., 1875.

§ Page 363, Dalton's Physiology.

‖ Pages 292–5 of this article.

salt than do the normal sputa and the healthy lung. The experiments by Dr. Lassar * have proved that inflammation lymph contains much more salt than does normal lymph. The experiments by Dr. Adolph Reuss † proved that inflammation-fluids contain more albumen than do transudates from healthy tissues. Dr. Lassar ‡ proved that inflammation-lymph contains much more fibrin than does normal lymph. M. Albert Robin ‖ and C. Wurster § have pointed out the influence of salt as an oxidizing agent, thus apparently connecting it with the change of albumen into fibrin.

HYPERINOSIS, HEART CLOT, AND FEVER.

A common cause of death in pneumonia is heart clot. Although believed to be due to an excess of fibrin in the blood, slowing of the blood current, and other conditions, its causation has never been fully explained. Perhaps some part of the explanation may be as follows:—

Normally, sodium chloride constitutes nearly 40 per cent of the mineral ingredients of the blood plasma.¶ Chloride of sodium protects the red corpuscles of the blood from solution.** As has been mentioned in this paper, during the progress of pneumonia the chloride of sodium is nearly absent from the blood, so nearly so that no chloride is found in the urine. Hence the dissolution of the red blood-corpuscles in the albumen is unimpeded by that agent—sodium chloride—which, Prof. Dalton says, has the function of protecting them. If dissolved in the blood the hæmoglobin from the red blood-corpuscles may then destroy the white blood-corpuscles, causing an increase in the amount of fibrin-ferment. †† According to Dr. Silbermann "1. Hæmoglobinæmia and hæmoglobinuria represent a process in which the white blood-corpuscles as well as the red are concerned. 2. The hæmoglobin which has been dissolved in the blood destroys the white blood-cells and thus occasions a decided increase in the amount of fibrin-ferment." * * * "4. If there are large quantities of the ferment developed as a result of the action of hæmoglobin in the blood, fatal thrombosis may occur, or an excessive stasis in the large abdominal veins, leading to a fatal anaemia of the brain." * * * "10. The fever attending both toxic and paroxysmal hæmoglobinuria is occasioned by the large amount of fibrin-ferment circulating in the blood."

Chloride of sodium, when present in considerable quantity, impedes the coagulation of fibrin and of albumen in the blood.‡‡ Therefore, when chloride of sodium is absent from the blood or nearly so, as in some stages of pneumonia, the fibrin, however formed, may more readily coagulate, and thrombosis occur.

Such a condition of the blood as must result from the nearly complete withdrawal of sodium chloride from the blood into the air-cells and air-passages might be expected, then, to favor (1) the dissolution of the red blood-corpuscles, (2) the destruction of the white blood-corpuscles, (3) the abnormal increase

* Pages 296 8, of this article.
† Pages 301 2, " "
‡ Page 296, " "
‖ Pages 298 9, " "
§ Page 299, " "
¶ Dalton's Physiology, 6th Edition, 1875, p. 260.
** Dalton's Human Physiology, Old Edition, p. 59; also Flint's Physiology, Vol. Blood, etc., p. 36.
†† Researches of Dr. Silbermann,—Zeitschrift für Klinische Medicin. Medical Record, N. Y., March 26, 1887, p. 355.
‡‡ Physiology of Man, Flint, Vol. Blood, etc., p. 36.

of fibrin in the blood, (4) the formation not only of thrombi but the slowly-forming nearly colorless heart clot, and (5) the production of fever.

A SUPPOSED CAUSE OF FEVER.

According to Dr. Silbermann previously quoted, "10. The fever attending both toxic and paroxysmal hæmoglobinuria is occasioned by the large amount of fibrin-ferment circulating in the blood."* Is it not possible that the fever is produced through the failure of some portion of the red blood-corpuscles, because of their dissolution, to carry the oxygen to the tissues (where the heat might be equalized and a normal proportion of it given off), and the consequent delivering over of a portion of the oxygen, through the agency of the hæmoglobin, to the oxidation of the albuminous constituents of the blood itself? Is not this the way the fibrin is formed in the blood,—namely, by the oxidation of the albuminous constituents, hyperoxidation resulting in hyperinosis?

OZONE AND PNEUMONIA.

Some years ago the late Dr. Henry Day, of Stafford, England, published accounts of his experiments on the causation of pneumonia and bronchitis, by ozone artificially prepared. He claimed that dogs caused to inhale ozone contracted bronchitis, and, if the inhalation were prolonged, pneumonia resulted. I do not know that his experiments have been repeated by others, but it is interesting to note that, in Michigan, the curve for atmospheric ozone by months is almost the same as the curve for pneumonia.† Ozone is a powerful irritant of the air-passages.

It seems probable that two or three relations which ozone may have to pneumonia are: (1) Its influence towards the exudation of the blood-serum into the bronchial tubes, and perhaps into the air-cells, because of its irritating effects upon mucous membranes; (2) its influence upon such effused serum towards the oxidation of the albumen into fibrin. There may be a third relation, through the powerful oxidizing properties of ozone, the fibrin in the blood being increased through its action. Dr. Sturges says: "Excess of fibrin, though it is observed in pneumonia most, is seen also in exudative inflammation everywhere; in simple pleurisy, in pericarditis, in fibrinous exudation from the kidney.‡ It is as though the fibrinous discharge which is common to all these affections were inadequate. The elements in excess accumulate in the blood notwithstanding, and the morbid deposit which is the expression of that accumulation relieves it but partially." § This view, however, is only hypothetical, and the same author just quoted says: "Thus (contrary to what might have been expected), it is after the occurrence of fibrinous exudation, and when the fibrin has been largely yielded up to the lung, that hyperinosis is the most extreme." ‖

Bearing upon the subject of the possible influence of ozone in the production of fibrin in the lung, and within the body, I quote from Miller's Chemistry as follows: "Analysis appears to prove that fibrin is a body which is

* N. Y. Med. Record, Mar. 26, 1887, p. 355.
† See Diagram No. 8, page 266.
‡ Dickinson's Pathology and Treatment of Albuminuria, p. 231.
§ The Natural History and Relations of Pneumonia, p. 173.
‖ Natural History and Relations of Pneumonia, p. 172.

more highly oxidized than albumen (see table, page 798); and coagulated fibrin, as it exists in muscle, is also more fully oxidized than that which separates from the blood on standing. Lehmann's view, that blood-fibrin is a state of transition between albuminous matter and the animal tissues, is thus rendered highly probable." *

OZONE, AND THE BODY TEMPERATURE IN PNEUMONIA.

The high temperature in pneumonia, which sometimes precedes the signs of local inflammation, is an important fact to be borne in mind in studying the causation of the disease. The high temperature also precedes the time of greatest fibrin in the blood.

If fibrin is oxidized albumen, an increase in the fibrin implies increased oxidation, and increased oxidation implies increased heat, so that, unless there was increased loss of heat by the body, fever should be the accompaniment of the formation of an abnormal amount of fibrin. On page 173, Natural History and Relations of Pneumonia by Sturges, is a footnote in which is the statement: "Andral asserts that the fibrin never exceeds ten parts per thousand without the temperature exceeding 104." This implies a belief in a fixed relation of fibrin to body temperature.

The inhalation of an atmosphere containing an unusually large proportion of oxygen in its most active state (ozone), may perhaps serve to explain the extra formation of the fibrin and also the production of fever; in which case the greatest amount of fibrin should be found (as it is in pneumonia) after the occurrence of the fever. (See page 174–5 of Pneumonia, Sturges.)

It is possible, therefore, that ozone may cause hyperinosis; and pneumonia, rheumatism, pericarditis, pleurisy, or albuminuria, may result from that hyperinosis. But in order that pneumonia shall result, I think it is proved, by the facts and considerations which I present in this paper, that in a majority of the cases at least, there must be exposure to the inhalation of cold dry air. That ozone is not the controlling cause of pneumonia, is apparent from a careful study of Diagram No. 8, page 266.

The sickness does not in every month follow quantitatively the rise and fall of the ozone, as it does follow the temperature (Diagram 1, page 252). Thus in March there is the most ozone, while the pneumonia is most in the month preceding; and there is least ozone in September, while the pneumonia has reached its lowest limit in August. Therefore, notwithstanding the very close relations proved to exist between the curves for atmospheric ozone and pneumonia, it must be concluded that ozone is not ordinarily the controlling cause, although it may be a powerful contributing cause of pneumonia.

Possibly the comparative absence of ozone from cities may account for the smaller death-rate from pneumonia in cities than in country districts, but it seems more probable that this is because of less exposure to the breathing of cold out-door dry air by the residents of cities.

OZONE, HYPERINOSIS, PNEUMONIA, CONSUMPTION.

Chemically, fibrin is oxidized albumen. It should not therefore be difficult to infer the direction in which we must search for the causation of

* Elements of Chemistry. Part 3. Organic Chemistry. William Allen Miller, M. D., etc., p. 807.

hyperinosis, namely, in the direction of causes of abnormal oxidation of the blood. This condition of the blood occurs in pneumonia, in rheumatism and in certain other diseases, and is believed by some to constitute an inflammatory condition of the blood—a tendency toward inflammation.* Thus in Aitken's Science and Practice of Medicine, Vol. 2, p. 508, Dr. Parkes is quoted as saying: "That hyperinosis is really anterior in pneumonia as in rheumatism, must, in spite of the opinion of Virchow, be considered likely, from experiments, among others, of Prof. Naumann, of Bonn."

It is conceivable that abnormal oxidation of the blood-serum may result from an abnormal proportion or activity of the red blood-corpuscles. In the same paragraph, quoted from Dr. Parkes, it is said: "It is well-known how frequently the liver is affected in pneumonia, so that some amount of jaundice is not at all uncommon, and sometimes bile-pigment appears in the pneumonia sputa. I have also found in some cases evidence of liver affection for some time before the lung-disease, especially the so-called torpor with deficient biliary flow." † Whenever the production of red blood-corpuscles continues at the normal rate, and they are not destroyed in the liver as fast as they normally are, it would seem possible that their accumulation may result in excessive oxidation of the albuminous constituents of the blood-serum,—in a condition described by the word hyperinosis.

But it is still more conceivable that abnormal oxidation of the blood-serum may result from the inhalation of oxygen in greater than normal amount, or in a condition of unusual activity; and ozone is oxygen in such active condition. Furthermore, the curve for the rise and fall of atmospheric ozone is, in Michigan, at least, almost precisely the curve for the rise and fall of pneumonia. (It is probable that the quantity of residual atmospheric ozone is controlled, to a certain extent, by the atmospheric temperature.) It may be added also that the late Dr. Henry Day, of London, England, claimed that his experiments with dogs proved that the inhalation of ozone caused bronchitis, and in larger quantities pneumonia.

While, therefore, I do not claim that atmospheric ozone is the sole cause of pneumonia, it seems quite probable that it may be a cause of hyperinosis, which is apparently a predisposing cause of pneumonia, and of other diseases.

It seems reasonable to believe that an exudate, which under other condi-

---

* Dr. Stokes has said: "The *precursory symptoms and diseases* on the invasion of pneumonia are various. Some of its complications will be spoken of at this time. Sometimes the patient has felt, for a few days preceding, discomfort, fatigue, anorexia, disinclination to motion, without either auscultation or percussion indicating pneumonia. Occasionally, a day, or two or three days before the attack, a slight fever, like that which precedes variola, scarlatina, measles, &c., accompanies the preceding symptoms. This is the inflammatory fever which, in the opinion of some writers, always precedes the local malady. In some cases all the organs are threatened in succession with disease; to-day the patient complains of gastric symptoms; to-morrow of a tendency to cerebral congestion; subsequently, to rheumatic pains, until, finally the pneumonia discloses itself. M. Andral has seen pulmonary inflammation preceded by two paroxyms of intermittent fever, and during the cold stage of the third a slight cough supervene, pain appear, the sputa of a characteristic nature; and, in fine all the symptoms of pneumonia evinced. Sometimes pneumonia succeeds bronchitis; the inflammation, at first limited to the large bronchia, extends to the smaller ones, and finally to the vesicles. Nothing is more common than the union of these two diseases; so much so indeed that some have declared that bronchial inflammation exists in every case of pneumonia."—"Lectures on the Theory and Practice of Physic," by John Bell, M. D., and William Stokes, M. D., Third Edition, Phila., 1845 Vol. II., page 135.

† Aitken's Practice, Vol. II., p. 508.

tions would be readily reäbsorbed or taken away by the lymphatics as fast as formed, may, under the influence of abnormal oxidizing action of ozone, become too insoluble to be thus disposed of, and consequently accumulate as the fibrinous exudate in pneumonia, in pleuritis, in croup, etc.

In Michigan, the curves for sickness and for deaths from pulmonary consumption seem to follow irreglarly the inverted temperature curve, about one to three months later in time. Consumption thus seems to be influenced by the same meteorological conditions as is pneumonia. And the consumption follows somewhat closely and quantitatively the rise and fall of the atmospheric ozone. In this connection, and in connection with what has just been said as to the difficult removal of oxidized exudates, it is worthy of notice that Dr. H. F. Formad, of Philadelphia, has claimed that a structural condition predisposing to consumption is abnormally few and narrow lymph spaces in the connective tissues.*

All of these facts seem to be in harmony with what I have suggested as to the fibrinous *nidus* being the controlling cause of certain communicable diseases which usually enter the body through the air-passages.†

THE ACTION OF COLD ON THE LIVING ANIMAL ORGANISM.

M. Brown-Séquard presented to the French Academy of Sciences a note, by M. Ch.-E. Quinquaud, having the above title. ‡ The results of the experiments therein mentioned bear upon the subject of hyperoxidation of the blood, also upon exaltation of reflex excitability; and inasmuch as it is proved in this article that atmospheric temperature has quantitative and apparently causal relations to pneumonia, and considerable attention is given to the indirect effects of low temperature, it seems important not to ignore any direct effects of cold which experiments have demonstrated to apply to the living organism. An abstract of the above-mentioned note is as follows:

It has been found that when warm-blooded animals are subjected to the action of cold the following phenomena are observable: The lowering of the central temperature is attended with weakening of all the functions; but nevertheless the reflex functions are intensified, as has long since been established by Dr. Brown-Séquard. That when the central temperature is reduced to 25°C. or lower, considerable exaltation of the reflex excitability of the spinal marrow is apparent, and the least shock then determines twitchings, and even generalized convulsive contractions. This phenomenon may be produced by slowly reducing the central temperature to 22°C.

Mr. Quinquaud ascribes this hyper-excitability, in part, to modification of the nutrition of the nervous elements, by increased oxygenation of the arterial blood, and states that at the moment of death the sanguineous liquid contains the maximum of oxygen which it is capable of absorbing.

In support of this he gives the results of experiments on three dogs as follows: Dogs weighing from 10 to 12 kilograms, plunged into a bath whose temperature is 11° become gradually cold and succumb with a central temperature of 19°; the blood in the left ventricle contains 31.5 c. c. per cent of oxygen, another part of the same blood is mechanically agitated with oxygen, and at the same

* "Tuberculosis usually ensues when a simple inflammation is set up by any kind of injury, in animals with the structural peculiarity which I have described; but tuberculosis can not be produced in animals that do not have this structural peculiarity, so far as my experiments show, unless the injury is inflicted upon serous membranes." Journal of American Medical Association, vol. 2, p 148.

† "Some of the cold weather communicable diseases." Trans. Mich. Med. Soc., 1887. Also, "The Relations of Certain Meteorological Conditions to Diseases of the Lungs and Air-passages," Trans. Internat. Med. Congress, Washington, D. C., 1887.

‡ *Comptes Rendus*, May 31, 1887, pp. 1542-1544.

temperature, is obtained, as respiratory capacity, 28.5 c. c. per cent.* Before cooling, the blood of the dogs contained an average of 23.5 c. c. per cent of oxygen.

The slowly cooling process produces *progressive "sur-oxygenation"* of the arterial blood, as shown by the following experiment: A dog weighing 13.500 kilograms is slowly cooled from 10:10 A. M. to 6:30 P. M. Before the cooling the blood contained 23 per cent of oxygen; at noon the central temperature is 31.2°; the blood contains 26 per cent of oxygen; and at the time of death 30 per cent.

The blood of another dog, before the bath at 11°, contained 23 per cent of oxygen, one and one-half hours later, the proportion was 28 per cent; the original heat of 39.2, had descended to 27.5°, and, after two hours and five minutes of immersion, the oxygen was 30 per cent, and the heat 22°.

Under the influence of cold, glycogenia, glycemia and glycosuria undergo remarkable variations. The same is the case with pulmonary exhalation. A rabbit cooled easily becomes glycosuric; in the dog there comes hyper-glycemia in the first period of refrigeration; prolonged cold baths are injurious to diabetics. When the central heat attains to 28° or 26°, the glycose diminishes in the blood of the animal cooled.

In regard to pulmonary exhalation, Mr. Quinquaud says as long as the central temperature does not descend below 30°, the quantity of carbonic acid exhaled augments; below 26°, it diminishes. A dog, before cooling, circulates 50 liters of air in eleven minutes, twenty seconds, and eliminates 1.20 grs. of carbonic acid; plunged into a bath of a temperature of 10°, in two and one-half hours, the central temperature descends to 30.3°, 50 liters of air circulate through its lungs in 18 minutes, and it eliminates 3.62 grs. of carbonic acid, proportionately the exhalation has increased.

But in the neighborhood of 25° the elimination diminishes; a dog causes 50 liters of air to circulate in 12 minutes, 46 seconds, and exhales, before the cold bath, 2.76 grs.; if cooled so that the central temperature falls to 25°, at that moment 50 liters of air circulate through its lungs in 22 minutes, 20 seconds, and it exhales 2.08 grs. of carbonic acid.

ATMOSPHERIC TEMPERATURE MAY HAVE A DIRECT, AS WELL AS AN INDIRECT INFLUENCE IN THE CAUSATION OF PNEUMONIA.

By the diagram (No. 1, page 252,) which shows the average temperature and the average sickness from pneumonia in Michigan for the eight years, it may be seen that the relation is extremely close. It is difficult to avoid the conclusion that it is a necessary relation—a relation of direct cause and effect. Nevertheless I have long been of the opinion that the relation is mainly indirect, and that it is the dryness rather than the cold which has most to do in the causation of pneumonia. Some of the reasons for this belief are the uniform absence of chlorides from the urine, their uniform presence in the sputa and in the inflamed lung,—these facts being easily explainable by the abnormally rapid evaporation of moisture from the lungs. But, on the other hand, there are certain facts which seem to show that a low temperature has a very great direct influence in the causation of pneumonia. As for instance, the fact that, in a proportion of cases, there has always been found to have occurred a direct exposure to cold, and the fact that the pleural surface of the lung is also so frequently the seat of a fibrinous exudation, and the difficulty of explaining that, as can be done for the mucous surface, by supposing the gradual accumulation of salt left behind by the abnormally rapid evaporation of moisture, and which therefore seems to require a different explanation. † This explanation may perhaps in part be found in the hyperoxidation of the blood, through the direct

* It may be that this standard is not correct; because it is possible that, in normal inhalation, ozone may be formed when the oxygen comes in contact with the moist alkaline surface of the air-cells. In fact these very experiments by Dr. Quinquaud, seem to prove that something of that nature must occur, because he found more oxygen in the blood of the refrigerated animals than in the blood exposed to oxygen at the same temperature outside the body.—H. B. B.

† Fibrinous exudates on the pleural surface of the lung have been observed by Sternberg and others after the injection of pneumonic sputum into the pleural cavities of rabbits. How much of the chlorides was injected in the sputum I do not know, but probably not much.

and indirect effects of cold, the influence of sodium chloride, ozone, etc., and in part in the engorgement of the pulmonary blood-vessels. The causation of the engorgement may perhaps be explained as follows: Exposure to the inhalation of air unusually cold (and what is unusually cold for one person is not necessarily so for another not acclimated to warmth) stimulates unusually the nerves which supply the lung. If the person then enters a warm room and inhales warm air, reaction occurs, which can perhaps be appreciated by remembering the appearance of the cheek of a person who has recently entered a warm room after exposure to severe cold out-door air. There is probably a very considerable paralysis of the blood-vessels of the part exposed, because of influence through the vaso-motor nerves, and this may, under favoring circumstances, lead to slowing of the blood currents, to congestion, which may proceed to inflammation and exudation.

DIRECT EFFECTS OF COLD.—ONE LOBE MAY BE MOST AFFECTED.

It is quite possible that the direct influence of cold may affect one lobe of a lung to a greater extent than any other portion, because of the more free entrance of the cold air into that lobe. The same, however, may be said of the indirect effect of cold in the direction of excessive evaporation from the air-cells, the evaporation would probably be greatest in that lobe into which most cold dry air entered; if so, the accumulation of the non-volatile salts of the blood would also be greatest in that lobe, and their irritating effects would be greatest there, as also the tendency towards the osmosis of the albuminous constituents of the blood. As regards the more direct effects of cold, any paralytic distension of the blood vessels through reaction from cold would be likely to occur in that lobe into which the most and coldest air entered.

After the most susceptible lobe has become so far hepatized that air does not enter it as readily as it does some other lobe, if the conditions tending toward the production of pneumonia continue, it seems reasonable to expect the disease to extend to another lobe, but when once the causation of pneumonia is proved to be as set forth in this article, it should be possible for a skillful physician to so control the conditions surrounding the patient as to prevent the extension of pneumonia to the lobes not at first attacked.*

Prof. Alexander B. Shaw, M. D., of St. Louis, Mo., has related cases illustrative of the view that pneumonia may be caused by disturbance of the circulation, etc., in the lungs, through perturbation of the vaso-motor center in the medulla oblongata, caused by irritation in other organs than the lungs—that is, in the stomach and liver. He quotes M. Foster as saying that "as a matter of fact, we find that just as the heart is affected, either in the way of inhibition or of acceleration by influences reaching it along certain nerves, so the action of the vaso-motor center may be exalted or depressed by nervous influences, reaching it from various sentient surfaces; that the exalting or depressing influence thus exercised may be brought to bear either on the whole vascular system, or a *particular vascular area*."† Dr. Shaw says: "Does not exposure to great extremes of temperature cause pneumonia by inducing neuro-paralytic hyperemia in a circumscribed area?" "Does not

* (Perhaps this is now quite commonly done by physicians, and by methods which are in harmony with these views of the causation—that is, by means of the oil-silk jacket, warm fomentations, or other measures of insuring warm, moist air for the patient to breathe, and the administration of carbonate of ammonia, or some similar agent, to render the hyperinosis as harmless as possible.)

† St. Louis Courier of Med., July, 1886, pp. 24–25.

the fact that, as a rule, but a portion of one lung [is affected], and that portion a complete lobe or lobes, harmonize more perfectly with the theory that the disease is preceded by perturbation of the particular vaso-motor center, or portion of the great vaso-motor center presiding over the nutrition of the area involved, than it does with the doctrine that pneumonia is caused by a microbe?"*

DIRECT EFFECT OF COLD.—SUDDEN CHANGES IN TEMPERATURE.

Exposure to sudden changes of temperature would be most likely to bring about pneumonia through these more direct effects of cold and reaction from cold; and exposure to sudden changes of temperature has long been an alleged cause of pneumonia. I have had tables and diagrams prepared showing the relations of pneumonia to the average daily range of atmospheric temperature, and have found, contrary to what might be expected, that there is most pneumonia in those months in which the average daily range of temperature is least, and least pneumonia when the average daily range of temperature is most. But a little reasoning shows that, notwithstanding this, the facts harmonize with the common belief: There is least pneumonia following the warmest weather, and most pneumonia following the coldest weather; and during the coldest weather is really the time when most sudden changes occur to civilized mankind, because man is not continuously exposed to outdoor conditions, and the change from indoor to outdoor conditions, or the reverse, in the coldest weather is vastly greater and incomparably more sudden than the average daily range of temperature out-of-doors at any season of the year.

DIRECT EFFCTS OF COLD.—COLD AND DAMP AIR.

The direct effects of cold will probably be greatest when the cold air is saturated with vapor of water, because of the greater specific heat of water than of air—the cold vapor of water will, probably, more rapidly than cold air, take away the warmth from the air-passages, although the evaporation of water is also a means of producing cold, and evaporation will be greatest when the air is least saturated with vapor. Whether air at zero F. is saturated with vapor or not makes very little difference, however, so far as relates to the amount of vapor which it will take from the air-passages when it is raised to the temperature of the air-passages, because the total amount of vapor which it can contain at zero is so insignificant (only about half a grain) compared with the amount (18.69 grains) which it contains when saturated at 98° F.†

EXPOSURE TO DRY WARM AIR.

If the evidence collected in this article, as to the effects of the inhalation of air unusually dry, is accepted as conclusive, that the effect of such inhalation is to increase the transudation of fluid from the blood into the air-cells to maintain their normal moist condition, to increase the proportion of the salts

* St. Louis Courier of Med., July, 1886, pp. 27-28.

† The relation of the pneumonia to the relative humidity by months, in Michigan, is shown in Diagram No. 4, page 258, and to the absolute humidity in Diagram No. 14, page 285, and the subject is discussed on pages 284-5 and 287-90.

of the blood (particularly the chlorides) in the air-cells (because the rapid evaporation of the fluid leaves the salts behind), to increase the tendency to the exudation of the albuminous constituents of the blood-serum into the air-cells, because of the rapid exudation of the fluid, and because of the unusual collection of salt in the air-cells, if this evidence is accepted, it follows as a matter of course that the commonly-accepted idea of "taking cold" must be modified to conform to these facts; because, according to this evidence, it is probable that pneumonia may be caused without any exposure to cold whatever, but only exposure to the inhalation of air which by the action of cold has been deprived of its vapor of water, and which has been warmed under such conditions that it has not gained that amount of moisture which warm air has such strong affinity for, and which it will take from the first moist surface with which it comes in contact. One has only to observe in winter in this climate the effects on furniture, etc., of such air in buildings heated by hot air to which no moisture is supplied, to be assured that the drying effects of such air are very great. And a psychrometer in a room thus warmed will not infrequently show a difference of twenty or thirty degrees F. between the dry-bulb and the wet-bulb thermometers,—this difference being caused by the rapid evaporation of water from the wet-bulb in response to the powerful attraction which such air has for vapor of water.

The foregoing may serve to explain how it is that pneumonia occurs so frequently in persons who have not been exposed to cold, and yet how it is possible that a curve representing all the sickness from pneumonia shall follow so exactly the curve representing the temperature of the out-door air as it is shown to do in Diagram No. 1, page 252. *It is the temperature of the out-door air which regulates the amount of moisture in air breathed in houses, except where there are laundries, kitchens, or other accidental sources of moisture, or where moisture is supplied artificially.* The supplying of moisture to the air of occupied rooms in quantities sufficient to be of much effect is very exceptional.

THE PREVENTION OF PNEUMONIA.

Running through all the clinical and other histories of pneumonia, the evidence is so strong as to be almost conclusive that in a very considerable proportion of cases of pneumonia there was no ascertainable exposure to cold. The facts which I have collected in this article are fully as conclusive that directly or indirectly pneumonia is controlled by the atmospheric temperature. This seems to imply that, at least in a "considerable proportion of cases," the control is indirect. It seems to me that the facts herein mentioned are sufficient to prove that that indirect control is through the absolute humidity of the atmosphere. If this is true, it follows that in a "considerable proportion of cases" this indirect control of pneumonia by the atmospheric temperature would disappear if it should come to be the universal custom to add to the air of inhabited rooms sufficient moisture to prevent that unusual demand upon the lungs and air-passages which the inhalation of air unusually dry always causes.

THE RELATIONS OF MICRO-ORGANISMS TO PNEUMONIA.

The "Germ theory of disease" is certainly proved to be true of some dis-

eases, to the extent, at least, that it is certain that if the living "germs," or specific micro-organisms of the particular disease gain access to the right portion of the body of a susceptible person, the disease is uniformly caused. Even before any micro-organism which seemed to have a causal relation to pneumonia had been found, the similarity of some of the symptoms of pneumonia to those of diseases known to be infectious, was pointed out by Jürgensen, and perhaps by others.* In 1877, Prof. Klebs found a bacterium which he believed to have a causal relation to pneumonia. In 1881, Eberth found an oval micro-organism. Then Dr. Koch, of the Imperial Board of Health of Germany, published illustrations of a pneumonia-coccus. Friedländer found in cases of pneumonia *post mortem*, round or elliptical cocci, frequently having what appeared to be a capsule enclosing them, the capsule consisting, as Friedländer believes, of mucine. But the capsule is no longer considered characteristic of that micrococcus. "Dr. Friedländer's first communication was made to the Medical Society of Berlin on the 19th of November, 1883."† Friedländer's "pneumonia-coccus" has been most spoken of, in this country, as a supposed cause of pneumonia. Fraenkel found in pneumonic lungs spindle-formed encapsuled micrococci, which he, at first, considered as perhaps identical with those of Friedländer. Prof. Weichselbaum found lancet-formed micro-organisms, probably the same as those found by Fränkel.

Talamon, in the laboratory of the Hôtel-Dieu in Paris, made investigations and many experiments upon animals with micro-organisms from the lungs of persons sick with or dead from pneumonia.‡ "Injections of liquid cultures directly into the pulmonary tissue of guinea-pigs and dogs gave a negative result." ‡ Sixteen of the twenty rabbits, inoculated in the same manner, died. "In eight rabbits there was fibrinous pneumonia, sometimes involving an entire lung, sometimes only the inferior lobe." ‡ Salvioli, in Italy, made similar experiments, but with more fatal results in rabbits, and fatal results from injections into guinea-pigs.§ In 1884, and 1885, Dr. George M. Sternberg, Surgeon U. S. Army, experimented with pneumonic sputum, and caused the death of rabbits, with pleurisy and fibrinous exudation upon the surface of the lung, but no pneumonia, although in one rabbit, into the thoracic cavity of which ordinary saliva only had been injected, pneumonia occurred. "There was but slight evidence of pleurisy, but the right lung was indurated, of a gray color, and sank in water." § "The development of pneumonia in this case was doubtless due to the fact that the point of the syringe had penetrated the lung, and the injection had been made directly into the lung tissue." §

Dr. Sternberg says: "I have been led to suspect, from the fact that while fibrinous pleurisy is a constant result in the experiments reported by Talamon and by Salvioli, fibrinous exudation in the lung tissue is only occasionally found, that perhaps the development of pneumonia depends upon the penetration of the lung by the point of the syringe and the injection of the infectious material directly into the lung substance. I can easily understand how this result might occur, if the local effect of the presence of the micrococcus in the lung is the same as when it is introduced into the subcutaneous connective tissue—that is, the infiltration of the tissue with an inflammatory exudate,

---

* An interesting brief resumé of some of the researches in Germany into the relations of micro-organisms to pneumonia, is given in the *Wiener Medizinische Presse*, Nr. 52, 1887, by Dr. Wilhelm Wolf. A few of his statements are here inserted, although this is not claimed to be a complete account of all that has been done in this field of research.

† Dr. Geo. M. Sternberg, p. 7 of paper "The Pneumonia-Coccus of Friedländer."

‡ Sternberg, p. 11. "The Pneumonia-Coccus of Friedländer." Sternberg, same article, pp. 12-13, refers to "G. Salvioli, Natura infettiva della pulmonite crupale. Arch. per le Scienze Mediche, Vol. viii., pp. 127-148 (1884)." Turin, Italy.

§ Same article, p. 18.

which gives rise to the appearance which I have generally spoken of as an inflammatory œdema." * "If this coccus is the germ of infectious pneumonia, one would think that to inject it subcutaneously ought to give rise to the local lesion [pneumonia], just as the subcutaneous injection of tuberculous sputum gives rise to tuberculosis of the lungs. We find from the accounts given that when injected into the lung, or introduced by inhalation, the micrococcus invades the blood, and produces enlargement of the spleen; but to produce the characteristic local inflammation which it is supposed to be the especial function of this micrococcus to produce, it does not suffice to inject the micrococcus beneath the skin or into the blood; it must be injected through the walls of the thorax with a sharp-pointed syringe. And when so injected only a certain proportion of the animals have pneumonia." † * * * "It is established that this is a pathogenic organism, so far as certain lower animals are concerned, and that its pathogenic power varies under different circumstances. It seems extremely probable that this micrococcus is concerned in the etiology of croupous pneumonia, and that the infectious nature of this disease is due to its presence in the fibrinous exudate into the pulmonary alveoli. But this cannot be considered as definitely established by the experiments which have thus far been made upon lower animals. The constant presence of this micrococcus in the buccal secretions of healthy persons indicates that some other factor is required for the development of an attack of pneumonia; and it seems probable that this other factor acts by reducing the vital resisting power of the pulmonary tissues, and thus making them vulnerable to the attacks of the microbe. This supposition enables us to account for the development of the numerous cases of pneumonia which cannot be traced to infection from without. The germ being always present, auto-infection is liable to occur when, from alcoholism, sewer-gas poisoning, crowd-poisoning, or any other depressing agency, the vitality of the tissues is reduced below the resisting point. We may suppose also that a reflex vaso-motor paralysis, affecting a single lobe of the lung, for example, and induced by exposure to cold, may so reduce the resisting power of the pulmonary tissue as to permit this micrococcus to produce its characteristic effects. Again, we may suppose that a person, whose vital resisting power is reduced by any of the causes mentioned, may be attacked by pneumonia from external infection with material containing a pathogenic variety of this micrococcus having a potency, permanent or acquired, greater than that possessed by the same organism in normal buccal secretions." ‡ * * * "It was by injecting my saliva as a control experiment that I discovered [in New Orleans, La.], in the summer of 1880, that it contained a pathogenic organism fatal to rabbits. In like manner Fränkel [in Berlin in 1883] discovered that his saliva contained the same organism, and, extending his experiment, ascertained that the saliva of other persons in health, or sick with various diseases, contained the same pathogenic micrococcus." §

In a paper read in April, 1885, Dr. Sternberg gave the name *Micrococcus Pasteuri* to the pathogenic micrococcus first observed by him in 1880, and which he considered the same as was observed by Pasteur, in the blood of a rabbit inoculated with the saliva of a child who died of hydrophobia in one of the hospitals of Paris, December 11, 1880.

The conclusion of an elaborate paper by Fränkel, according to the translation by Dr. Sternberg, is as follows: "Finally, as regards the relative frequency in cases of pneumonia, of the two hitherto investigated microbes, [Friedländer's pneumococcus, and *Micrococcus Pasteuri, Sternberg*] no positive statement can yet be made. Nevertheless, I am inclined to regard the lancet-shaped pneumonia-coccus, which is identical with the microbe of sputum-septicæmia [*Micrococcus Pasteuri, Sternberg*], as the more frequent and the usual infectious agent of pneumonia, on the ground that this organism is so much more frequently found in the sputum of pneumonic patients than in that of healthy individuals. This conclusion is further supported by the circumstance that it has not hitherto been possible to isolate directly from the rusty sputum, Friedländer's bacillus." ¶ ‖ Dr. Sternberg says: "No doubt, Talamon's results were due to the presence of *M. Pasteuri* in the pneumonic material and culture-fluids which he used in his inoculation experiments. This is shown by the fact that sixteen out of twenty rabbits injected died, while Friedländer's coccus does not kill rabbits." ¶

"The experimental evidence on record shows, then, that *M. Pasteuri*, which is present in the buc-

---

* "The Pneumonia-Coccus of Friedländer," p. 17.
† "The Pneumonia-Coccus of Friedländer," p. 19.
‡ "The Pneumonia-Coccus of Friedländer, p. 21.
§ "The Pneumonia-Coccus of Friedländer," p. 23.
¶ "The Pneumonia-Coccus of Friedländer," p. 28.
‖ Since that time, Prof. Weischelbaum, in five cases of inflammation of the lungs, was able to prove the micro-organisms described by Friedländer as the agent of infection.—*Wiener Medizinische Presse, Nr. 52, 1887, Seite, 1773.*

cal secretions of healthy individuals in various parts of the world, is also found, with greater certainty, in the exudate of croupous pneumonia. Whether it is found in this material simply because it is at hand in the buccal cavity, and finds in the pneumonic exudate a suitable medium in which to develop, or whether it is concerned in the etiology of croupous pneumonia, is an unsettled question. We have experimental evidence, however, that this micrococcus does give rise to local inflammation, accompanied with a serous or sero-fibrinous exudate, when it is injected into the subcutaneous connective tissue, or into the pleural cavity of rabbits." * * * * "This hypothesis does not exclude the view that Friedländer's micrococcus, and perhaps other pathogenic organisms, may act in like manner." * * * * "Thost,[2] of Hamburg, has demonstrated the presence of Friedländer's coccus in great numbers in the nasal secretions of patients suffering from ozæna." †

When shown some of the evidence which I have collected proving that the average amount of pneumonia in Michigan, and in other parts of the world, is absolutely proportional, inversely, to the temperature and humidity of the atmosphere, a friend said: "That shows that the reproduction of the pneumococcus is controlled by the temperature"; but this cannot be the true explanation, because the temperature of the air-passages is tolerably constant, and probably does not differ much at the different seasons of the year. The explanation seems to be that after the exudation has been caused in the manner I have pointed out,—by the action of the cold, dry air, the accumulation of salts, and the albuminous matter, the micro coccus which is generally present in the saliva is able to reproduce itself in the exudate, not only in its ordinary habitat, the mouth, but also in an extended area in the air-passages, and in the pulmonary alveoli, so far as the exudate extends. And whether an unusual exposure to the inhalation of cold, dry air shall result in an influenza, pharyngitis, laryngitis, bronchitis, or pneumonia, may depend upon whether the extra moisture exhaled shall have been supplied by the first mucous surface with which the cold, dry air came in contact, in passing through the nose (influenza), or the second portion (pharyngitis), or the third (laryngitis), or the fourth (bronchitis), or the air-cells themselves (pneumonia). This may explain why it is that the curves for all of these diseases are so similar and why the curve for each disease follows so closely the curves representing atmospheric temperature and absolute humidity as to indicate a controlling causal relation of cold dry air to each of these diseases.

Possibly the characters of the different micro-organisms, which may be present, or come to the exudate, and be able to multiply in it, may have a bearing upon the character of the pneumonia; this is in accordance with what is known of micro-organisms. ‡ But it seems most important first to have a clear idea of the manner in which is brought about the exudation—the most important phenomenon in croupous pneumonia; and, in my opinion, an important if not the controlling factor in the other diseases of the air-passages, and in those communicable diseases which enter the body through the air-passages.

Dr. Sternberg has spoken (page 315 of this article) of the possible causation of the inflammatory exudate in the lung by the injection of the infectious

* "The Pneumonia-Coccus of Friedländer," p. 27.
[2] Pneumoniekokken in der Nase, Deutsche Med. Wochenschrift, No. 10, March 11, 1886.
† "The Pneumonia-Coccus of Friedländer," p. 29.

‡ In connection with the preceding paragraph, this may explain how it is that among a large number of children exposed to the inhalation of cold or dry air, some will have influenza, some coryza, some simple tonsilitis, some croup, some diphtheria, some diphtheritic croup, some bronchitis, some scarlet fever, and some pneumonia. All of these diseases follow, as a rule, exposure to the inhalation of cold or dry air; but some of them require, in addition to such exposure, exposure to the microscopic specific cause of the disease.

material directly into the lung substance. He has found that when this infection (*Micrococcus Pasteuri*), is introduced into the subcutaneous connective tissue in the rabbit, it gives rise to the infiltration of the tissue with an inflammatory exudate—a condition which he has called "inflammatory œdema." But it cannot be possible that the specific micro-organism of pneumonia, if there is a specific organism, can under ordinary conditions penetrate the lung substance, or of itself alone cause pneumonia. Dr. Sternberg says: "The constant presence of this micrococcus in the buccal secretions of healthy persons indicates that some other factor is required for the development of an attack of pneumonia." I would add that the evidence which I give in this article makes it certain that, whether the specific cause of pneumonia is or is not constantly present, the causation of pneumonia is absolutely controlled, directly or indirectly, by the atmospheric temperature. Pneumonia seems to be more closely and causally related to temperature than to any other known condition, unless it is the absolute humidity, the curve for which is about the same as for temperature, and which condition is generally controlled by the temperature. The direct effects of cold and reaction from cold seem to be insufficient to account for all of the phenomena of pneumonia. I believe it is through the absolute humidity of the atmosphere, the evaporation of the pulmonary mucus, the accumulation of the salts, and the exudation of the albuminous constituents of the blood-serum into the saline mucus, that atmospheric temperature controls the amount of pneumonia; and that while there may be a *specific* cause, and while this atmospheric cause may be called the *controlling* cause of pneumonia, a very probable *predisposing* cause is the presence in the body of an abnormal quantity or quality of salts, among which should be mentioned the chloride of sodium.

As to simple catarrhal pneumonia, and ordinary bronchitis, the irritation caused by the unusual collection of non-volatile salts, left by the excessive evaporation of vapor, caused by the inhalation of dry air, seems to me a sufficient cause.

On preceding pages, 300–1, I have mentioned a few facts which tend to show that bronchitis is caused by a less exposure, or at least that more bronchitis than pneumonia is caused by precisely the same exposure, indicating, perhaps, that for the causation of pneumonia a greater concentration of the non-volatile salts is required than for the causation of bronchitis. This is in harmony with the law of osmosis of albuminous substances to a solution of salt, but not to water alone.

While expressing as I do the view that it is the exudation on the different portions of the air-passages, which, as a rule, supplies a *nidus*, and makes it possible for the different microscopic organisms to gain a lodgment, I do not consider it impossible that other views, such as those quoted from Dr. Sternberg, as to their gaining a lodgment through any depressing influence, may be correct; and it may be useful to consider, in this connection, one very important fact which, so far as I know, has never been referred to in explanation of the causation of pneumonia: The ciliated epithelium, which extends down to the bronchial tubes of one line in diameter, has much to do with the movement up and out of the air-passages of any extraneous particles. Prof. Kölliker says: "The *cilia* are of much more delicate consistence than the cell-membrane, and are very readily detached upon any maceration of the epithelium; more or less altered by almost all reagents, they are, by many, at once destroyed." Yet, according to Kölliker, "Even in diseases of

the respiratory passages, the detachment of the ciliated cells is by no means so common a phenomenon as is believed by many, and the *epithelium* may be frequently found uninjured under puriform mucus, or even beneath croupous exudations."* Dr. Da Costa adds: "The motion of the cilia is destroyed by many chemical and mechanical agents," among which he mentions ammonia, although potassa and soda stimulate the motion of the cilia.† It is quite conceivable, although so far as I know it has not been proved, that the motion of the 10 to 20 cilia on each cell may be retarded, or even stopped by the influence of unusual cold, or the reaction from cold, due to exposure to the inhalation of cold air; and that, in consequence of the stoppage of such upward movement of the cilia, the inhalation of the dust-laden air of an inhabited room might then carry down into the bronchiæ, and even to the air-cells, the microscopic organisms which are generally distributed, or those which are only distributed in the vicinity of persons who have certain diseases. Under such circumstances "germs" which ordinarily would be stopped at the larynx, or promptly brought back from the bronchiæ, might perhaps be permitted to reach the air-cells. If, however, the inhalation of cold or otherwise dry air, and the excessive evaporation caused thereby, shall have resulted in the accumulation of a mucus unusually saturated with salts, the movements of the cilia may be even more seriously interfered with, and if this shall have gone on until exudation of the albuminous constituents of the blood serum has occurred, the movements of the cilia may be yet further interfered with, and rendered unavailing for the prompt outward movement of micro-organisms or irritating mucus which ordinarily would be carried upward and out of the air-passages.

SOME MICRO-ORGANISMS MAY BE USEFUL.

Before leaving the subject of the relations of micro-organisms to pneumonia, it may be mentioned that Pasteur has isolated seventeen species of micro-organisms found in the mouth of healthy persons. He added some of these to various substances used as food. When added to fibrin, ten, of the seventeen, varieties of organisms, dissolved it completely. ‡

Is it not possible that recovery from croupous pneumonia is favored by the presence of some of these micro-organisms which are found in the mouths of healthy persons, and which Pasteur has found dissolve fibrin completely? It would seem that recovery from that disease cannot occur except the exuded fibrin be dissolved.

PNEUMONIA AFTER TRACHEOTOMY AND SIMILAR OPERATIONS.

A recent account of removal of the larynx mentions the death from pneumonia of two persons soon after undergoing this operation.§ Deaths after tracheotomy are frequently from pneumonia or bronchitis; thus in Aitken's "Science and Practice of Medicine," in speaking of tracheotomy in croup, it is stated that "The causes of death after the operation are mainly pneumonia, bronchitis, or the severity of the constitutional febrile state (Syden. Society Year-Book, 1863, p. 278)."¶

* Kölliker's Microscopical Anatomy, pp. 570-1.
† Kölliker's Microscopical Anatomy, p. 571.
‡ Phila. Med. News, Sept. 17, 1887, p. 336; Also N. Y. Med. Abstract, 1887.
§ "A late number of the *Medical* Times," p. 113, Am. Lancet, Mar., 1887.
¶ Aitken, Vol. II., p. 447.

My explanation of this is that the pneumonia and bronchitis after tracheotomy are caused by the inhalation of air which is colder and drier than the lungs have been accustomed to, because, normally, the air which reaches the lungs has been warmed and moistened by contact with the warm moist surfaces of the nose, pharynx, and larynx. My belief is that pneumonia and bronchitis need not occur after tracheotomy if sufficient care be taken to ensure that the air inhaled shall enter the trachea at a temperature not much below 98° F., and saturated with vapor of water.

PNEUMONIA, AND DEPRESSING EMOTIONS.

Cases of pneumonia sometimes occur in which it would seem that depressing emotions had to do with the occurrence of the disease. Is it not probable that in such cases the influence toward pneumonia is through disturbed action of the heart, and that the disturbance of the blood-pressure in the lungs may, under favoring conditions, have influence in the causation of pneumonia? Direct evidence on the subject of blood-pressure in its relations to pneumonia, is not available; but on pages 263 and 287 of this article is evidence as to the relations to pneumonia of average daily fluctuations of the atmospheric pressure.

RELATION OF KIDNEY DISEASES TO PNEUMONIA.

If one accepts the view of the writer of this paper—that excess of the chlorides in the blood probably favors the occurrence of pneumonia, and is, therefore, a predisposing cause; and considers in this connection the experiments by Dr. Hoppe, mentioned on page 304 of this article, which seem to prove that albumen passes by osmosis not only to sodium chloride but also to a solution of urea; and then considers that, normally, sodium chloride and urea are both excreted by the kidneys, then it would seem that whatever lessens the functional activity of the kidneys should predispose to pneumonia, and, so far as relates to the excretion of sodium chloride, this predisposition should be especially strong whenever the excretion of the chloride through the perspiration is lessened, as it is by the action of cold. Accordingly, we should expect that in those diseases of the kidneys in which their functional activity is greatly lessened, there should be danger of pneumonia, especially on exposure to the inhalation of air unusually cold or otherwise dry, because of the danger of the accumulation of the chlorides and perhaps of urea on the mucous surfaces of the air-passages. The following paragraph, therefore, seems important:

Speaking of the diseases most associated with pneumonia, Dr. Sturges says: "Thus it will be seen from the appendix that renal disease figures largely among the pre-existing morbid conditions of the individuals enumerated." * He also says: "It appears upon calculation that pneumonia in kidney disease is most frequent in the so-called amyloid or waxy degeneration. According to Dr. Dickinson, the marked tendency to inflammation† which characterizes this change is seen most conspicuously in the lungs, and next most often in the pleura." ‡

* "Natural History and Relations of Pneumonia." Octavius Sturges, M. D., F. R. C. P., London, 1876, p. 81.

† Compare this with what is said on a preceding page of this article relative to sodium chloride in inflammation-lymph; and also, relative to hyperinosis and the chlorides.

‡ The same Vol., p. 82.

THE KIND OF PNEUMONIA TREATED OF IN THIS PAPER.

The uniformity of natural law seems to require that different diseases should have causes differing correspondingly, and that different forms of pneumonia should have different causation. Physicians have been looking for one mode of causation of croupous pneumonia, and another of catarrhal pneumonia; and Professor Germain Sée * disbelieves the thirty-years' statistics in London, compiled by Buchan and Mitchell, because they show that the curves for pneumonia and bronchitis are similar. Nevertheless, it seems quite possible that inflammation of one portion of the lining of the air-passages may have the same cause as inflammation of a contiguous portion, that the character of that inflammation may be modified by the condition of the patient, so that it may be catarrhal or croupous, that whether the inflammation shall occur at all or not may be determined by conditions of the blood predisposing, and that, as suggested in another place in this paper, pneumonia may perhaps be averted in a case in which, in response to the exposure to the inhalation of cold dry air, the fluid poured out in the nose and upper air-passages is so profuse as to completely saturate all air inhaled, while it is also warmed before it reaches the air-cells. While in such a case influenza might occur, or, if the effect was responded to lower down, bronchitis might result, pneumonia might not, in that person, although it might in an accompanying person, whose upper air-passages did not so promptly respond to the influence of the exposure. It does not seem difficult to see how it is that not only are the curves for bronchitis and pneumonia similar, as pointed out by Buchan and Mitchell,† and as demonstrated in this article, but how, as shown by numerous diagrams which I have before me, these are similar to those for influenza, croup, tonsilitis, and other diseases of the air-passages.

Statistically and causally, the pneumonia treated of in this paper, must be all, or nearly all of one kind, because, whether it is in Michigan, in the U. S. army during the war of the rebellion, in London (England) or in India it uniformly follows about the same curve, and uniformly follows the temperature curve of its locality. The reports of the sickness in Michigan do not specify croupous pneumonia, the printed blank reads simply "pneumonia." The cases of sickness in the U. S. army are published as from "pneumonia." The same is true of the deaths in the army and in London. Therefore, the kind of pneumonia treated of in this paper is the usual kind, the most common kind, unless it be that the causation of all kinds is similar, so far as relates to the controlling condition.

IMPOSSIBILITY OF READILY COMPARING STATES AND COUNTRIES AS TO CAUSATION OF PNEUMONIA.

At first sight it seems practicable to compare the atmospheric conditions in one state and country with those in other states and countries, and, by comparing the respective death-rates from pneumonia, to learn in that manner, what atmospheric conditions tend to cause pneumonia. Several writers have attempted to do this. And it is quite probable that the absence of such comparisons from this article will be noticed. But, after close examination

* "Diseases of the Lungs." William Wood & Co., New York, 1885, p. 73.
† Journal of the Scottish Met. Soc., July, 1874—July, 1875.

of the subject, it would seem to be impossible to compare directly the death-rates from pneumonia in different countries, states, or cities, for the reason that the mortality from this disease differs so greatly among persons at different ages and sexes; pneumonia affecting especially the very young and the very old, and the males in greater proportion than the females. At first sight, it may not be apparent how greatly the inhabitants of certain states differ in age and sex from those of certain other states, and how great is the effect of such difference upon the death-rates from such diseases as pneumonia. Thus, for instance, according to the United States census of 1880, the females in Massachusetts exceeded the males by 66,205, while in Michigan, on the other hand, the males exceeded the females by 86,773.

With sufficiently good vital statistics, and statistics of population, it will be practicable to learn the per cent of deaths from pneumonia at each period of age to the inhabitants of that period of age and of the same sex, in each city, state or country, and then the comparison of one city, state, or country with another may safely be undertaken; but the data for such labors are not yet easily obtained, and, when they shall be obtained, the labor of the computations will be very great, and should be undertaken by the general government.

It is apparent, however, that diseases of the lungs and air-passages are much more common among the people of the northern and eastern States of this Union, than among the same people while they are in Florida or California. And it is apparent that the chief differences in climate are the greater warmth and moisture of the atmosphere in Florida and in California. And those differences are much the greatest at those seasons of the year when at the North there is the greatest danger from diseases of the air-passages. These are important facts which people do well to heed, and which it is to be hoped will be made still more useful, now that the reasons for action are so strongly set forth.

TO LEARN THE CAUSATION OF PNEUMONIA, THE STATISTICAL METHOD IS ESSENTIAL.

Heretofore there have been very few opportunities to study records of *sickness* from pneumonia with records of atmospheric temperature where the cases of sickness were sufficiently numerous to make a true curve.

One physician's experience is hardly sufficient to establish anything definitely as to the relations of a disease to a meteorological condition. The "statistical method" is essential for any such study; and that method depends upon the "law of probabilities," and the fact that in all collections of data respecting any given subject the chances of error are lessened by increasing the number of the observations, the number of the observers, and the conditions under which the observations are made. With one observer and few observations, all under similar conditions, the results may be similar for all the observations; while at the same time another observer under different conditions may find results concordant among themselves, but different from those of other observers. But one skilled in the statistical method may, by means of the law of probabilities, so combine facts (if he can find them recorded) respecting large numbers of observations, by different persons, and in different countries, as to show with great certainty many facts which cannot otherwise be known.

During the war of the rebellion, there was a sufficient number of surgeons observing, and the cases of pneumonia were sufficiently numerous so that the records of the U. S. Army Surgeon-General's office, tabulated in the Medical and Surgicial History of the War, supply data of sickness from pneumonia of great value for the purposes of study of this disease. The recorded experience with pneumonia of the hundreds of U. S. army surgeons during the years 1862, 3, and 4, are condensed and shown in connection with the temperature curves, in the tables and diagrams which accompany this article. And the evidence coincides with that which relates to pneumonia in Michigan.

The statistics of sickness from respiratory diseases in the armies in India, teach very much the same lesson that we learn from the statistics in our own armies. This is important, especially because the atmospheric temperature is so much higher in India.

Although deaths might not be expected to be as closely related as sickness is to meteorological conditions, it is instructive to see (in Diagram No. 11, p. 273) how closely the curve for deaths in London, England, follows the curve for atmospheric temperature.

GENERAL LAWS RELATIVE TO THE CAUSATION OF PNEUMONIA.

It seems plain that whether we study the subject in the comparatively cold atmosphere of Michigan, in the warmer climate of the region occupied by the U. S. armies during the late war, or in the extremely warm climate of India, the general law, which is elaborated in this article, holds true; and it holds true in that still different climate of London, England. The researches of Dr. Seibert, referred to on a preceding page, have shown that it holds true in New York city, and in Germany.

That the curves relating to sickness and atmospheric temperature in Michigan (in Diagram No. 1) show closer relations than do those for other parts of the world, is, in my opinion, accounted for by the fact that the details of the observations and reports were more accurately attended to: The meteorological observers were supplied with standard thermometers, the meteorological stations were representative of the area in which the sickness was, the reports of sickness were made weekly, and by leading physicians in active practice, and the compilation of the meteorological and of the sickness statistics has been done with very great care to learn the exact truth.

My own view is that the truth respecting the causal relation of atmospheric temperature to pneumonia is now established. I believe it is a general law, applicable throughout the world.

It should be borne in mind that, except that the absolute humidity of the atmosphere, so far as relates to its maximum, is controlled by the temperature, the meteorological evidence is about as strong in favor of a causal relation of absolute humidity to pneumonia as it is of such a relation of temperature,—the curve for pneumonia follows the curve for absolute humidity with nearly as great uniformity as it does the curve for temperature. This is not illustrated by diagrams for all the different localities, but any one who really grasps the relations which absolute humidity and temperature necessarily sustain, does not need such illustrations; because, given the curve for atmospheric temperature, he knows, approximately, what the curve for absolute humidity must be.

But the evidence which I have collated relative to the influence of absolute

humidity does not end with the meteorological evidence. The evidences of chemistry, of physiology, and of pathology coincide with, and combine to supplement it in ways which seem to me to establish as a general law, applicable throughout the world, the fact that the inhalation of air unusually dry tends to increase on the mucous lining of the air-passages the proportion of the non-volatile salts of the blood.*

The evidence seems to be conclusive that, both as regards those effects of the inhalation of air unusually cold which are due to temperature alone, and those effects which are due to the abstraction of vapor of water from the lungs and air-passages by the inhalation of cold air (which by reason of a well-known natural law is always dry air), the tendency of both these effects is toward the exudation, not only of the non-volatile salts of the blood, but also of the albuminous constituents of the blood, in other words toward inflammation of the lungs and air-passages.

Finally, the evidence seems to be conclusive that, whatever relation micro-organisms may sustain to pneumonia, the sickness from pneumonia, and the mortality from pneumonia, both are quantitatively related to the atmospheric temperature, and to the atmospheric humidity in the locality.

Not all the lines of evidence followed in this article are summarized in the last few preceding paragraphs; but the attentive reader probably has them in mind. It would seem that the principal factors in the causation of pneumonia have now been discovered and set forth.

As suggested at the beginning of this article, page 246, it is probable that mankind will soon find ways whereby the natural conditions may be controlled, whenever it becomes certain how those conditions need to be modified in order to avoid pneumonia. The fact that out of large numbers of persons, similarly exposed to atmospheric conditions, only a certain proportion contract the disease, shows that there are predisposing conditions which we should learn and heed. If it proves that the excessive use of salted foods predisposes to pneumonia and other diseases of the air-passages, knowledge of that fact may lead to the prevention of the disease by means of a better food supply.

Better knowledge of the causation of pneumonia should lead to the saving of life through more rational treatment of persons sick with pneumonia.

For the prevention of pneumonia, the evidence of this article goes to show that one measure is of very great importance, namely, the proper moistening of all air which requires to be warmed, in houses, offices, public buildings, hospitals, asylums, and wherever such conditions of the air inhaled can be controlled.

If it shall be found that the exposures out-of-doors are sufficient to cause pneumonia, even after the in-door conditions have been made satisfactory, it is not probable that a race of people capable of taming even the lightning, so as to make it subserve the purposes of ordinary lighting, the conveying of messages, the voice of man, and even of man himself, will be unable to so control the temperature and humidity of the air man breathes that he shall be protected, by respirators or otherwise, from serious harm by either coldness or dryness of the atmosphere.

What is essential, is that we shall grasp and appreciate the truth.

HENRY B. BAKER.

---

* The fact that during the onward progress of pneumonia the chlorides disapper from the urine, has long been well and generally known; I trust that it may soon be equally well and generally known that under those circumstances, as proved by Lionel S. Beale, those chlorides accumulate in the sputa and in the affected lung.

INDEX.